ENGINEERING IN A MOUNTAIN RESORT TOWN

A Record of Study

by

ERIC W. WATERS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF ENGINEERING

December 2007

Major Subject: Engineering
College of Engineering

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Approved by:

Chair of Committee,	Stuart Anderson
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ABSTRACT

Engineering in a Mountain Resort Town.
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This Record of Study (ROS) summarizes the experiences and lessons learned while serving as an intern with Peak Land Consultants (PLC) in Vail, Colorado. The objectives of the internship were designed to provide benefits to myself, the United States Air Force Academy, and PLC. The first objective was to develop a business plan for a similar company in a mountain community. This provides a useful tool to begin a second career after retirement from the Air Force. The second objective was to build lesson plans based on the experience at PLC for the Air Force Academy cadets. Through the use of real engineering examples and by integrating civil engineering subjects across the curriculum, Air Force Academy cadets will be better prepared for their professional life as a civil engineer. The last objective was to provide PLC with an objective management review. The management review highlighted good practices and provided recommendations for further improvement in areas such as marketing, communication, project management, training, and company goals.

Each one of the objectives was tested. The business plan was provided to a loan officer at Wells Fargo bank. The loan officer remarked that the plan was well researched. He also indicated that the bank was willing to provide a loan for the business. This positive result indicated that the objective to develop a business plan for a similar company in a mountain community was met. The second objective to build lesson plans for the Air Force Academy was also met. These plans were presented to a senior class in April 07. The cadets liked the idea of seeing how an engineer solves problems in the private sector. In addition, the cadets recognized the usefulness of AutoCAD in solving problems in their other classes. Finally, the objective for providing a management review of PLC also proved to be successful. PLC has already implemented a number of recommendations from the review and is using the review to build new company and employee goals.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation for my committee chair, Dr. Anderson, and my committee members, Dr. Reinschmidt, Dr. Trejo, and Dr. Gresham, for mentoring me throughout my time at Texas A&M. Because of their patience in answering my many questions over the past three years, I have developed a better perspective on project management in civil engineering. I know this new perspective will provide untold dividends as I move on in the Air Force as Chief of Reconstruction for Iraq Freedom. Thank you.

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CHAPTER I
INTRODUCTION

This Record of Study (ROS) documents the body of knowledge gained while working in an internship position with Peak Land Consultants (PLC) in Vail, Colorado. The specific organization of the ROS is intended to guide the reader through the entire internship process. It does not just cover the actual year spent working at PLC. Instead, the document begins by providing insight into the reasons for choosing an internship in a small company in a resort town. Continuing, the document provides a company profile of PLC. Next, a description of the general duties and responsibilities for the internship are outlined. After presenting the final objectives, the final part of the ROS is devoted by chapter to describe how each objective was met; the development of a business plan to build an engineering and architectural company, the creation of lesson plans for the US Air Force Academy, and a management review of PLC.

REASONS FOR CHOOSING A SMALL ENGINEERING FIRM

The two principal reasons for choosing a small engineering firm are personal. The first reason comes from experiences gained while serving in the Air Force over the last fourteen years. Life in the military requires frequent moves. Although there are negative aspects of living a nomadic life, it provided the opportunity to experience a wide variety of places including Saudi Arabia, Korea, Japan, Germany, and Australia. During this time, my favorite assignments have been the ones closest to the Rocky Mountains where extracurricular activities revolve around the different mountain seasons. It is very difficult to find a better place to snowboard in the winter and kayak in the summer. Therefore, after retiring from the Air Force, the author wants to begin a second career somewhere in the Rocky Mountains.

The second reason for choosing a small engineering firm is to experience how a company can survive and operate in an environment with limited resources. Because retirement from the Air Force is usually just a point to start a second career, a person must be able to find an occupation that can support a chosen life style. Being a civil engineer in the military provides the opportunity to transition to a similar civilian engineering position. However, there is a

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This record of study follows the style of *Journal of Construction Engineering and Management*.

significant difference in practicing engineering on a technical level versus engineering on a typical Air Force management level. To be successful, you must be confident in your abilities to use and apply the basics of engineering to solve client's problems on time and on budget.

There were a number of insular reasons for choosing a small mountain company. Most of them were the direct result of being stationed at the Air Force Academy. This location required the interaction with several local engineers in the area. These meetings ended in discussions concerning retirement in the local area. These individuals completely supported the idea of such a radical change from the bureaucracy of the federal government. The only negative aspect of any retirement plan was the high cost of living in the mountains. Having an Air Force retirement helps to overcome this obstacle.

All of these reasons pointed to an internship position at PLC. Working at PLC and investigating the positive and negative aspects of a small company allows the chance to decide if pursuing this course of action upon retirement makes personal and financial sense.

PEAK LAND CONSULTANTS' COMPANY PROFILE

The first person to greet you when you walk through the door of PLC is the company's office manager, Ms. Connie Nunley. Her welcome is quickly followed by a nuzzle from one or more of the employees' dogs. This warm reception is typical of a mountain company where it is common practice to bring your dog into work. The relaxed atmosphere is complemented by ski racks in-between the cubicles, pictures of rafting and hiking on the walls and the occasional FedEx package with the latest outdoor gear. This relaxed climate is exactly what the owner, Mr. Brent Biggs, wants to present to his clients. This is truly a company where the employees like to work and play in the mountains.

Even if it is not obvious on the outside, the company is outfitted with the latest in engineering and surveying equipment. For example, the surveyors are quite adept in using the newest GPS instruments. Although the engineering side of the house works with one of the latest versions of AutoCAD, they are in the midst of transitioning to AutoCAD's newest 3D civil design software to provide even more enhanced service to their clients.

This service began in 1997 when PLC was formed to bring together two related services into one office providing a full service company from design conception through completion of a project. PLC owns and operates both Peak Land Surveying, Inc. (PLS) and Peak Civil Engineering, Inc.

(PCE) from offices located in Vail, Colorado. This in-house partnership allows better coordination between specialties providing greater efficiency and quality for the client. The companies of PLC have served over 500 individual clients in the Rocky Mountain Region. At the present time, PLC has three engineers on staff managed by a senior project manager. In addition, PLC has a staff of six surveyors managed by the owner, a registered professional land surveyor. An organizational chart is shown in Figure 1. PCE offers complete civil engineering services and cost estimating ranging from initial project planning to construction. Typical types of PCE projects include:

- Residential Subdivision Design
- Commercial Site Development
- Drainage and Floodplain Studies
- Road and Street Design
- Water and Sewer System Design
- Storm Sewer Design
- Highway Access Permits

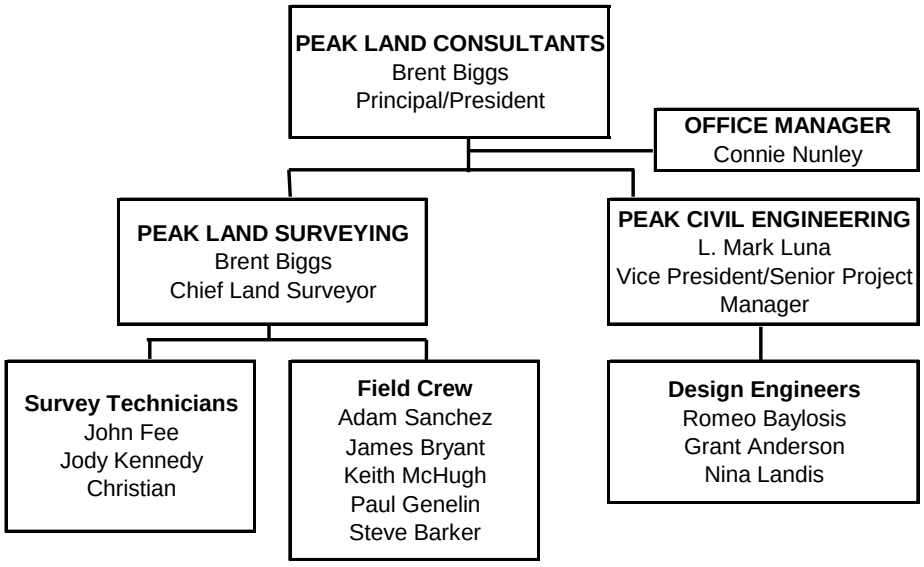

Figure 1: PLC Organizational Chart

PLC's profile would not be complete without explaining the tangible and intangible benefits of working at the company. Mr. Biggs provides all the employees with a comprehensive health care program, a matching 401(k) retirement plan, and higher than average salaries. In reference to intangible benefits, Mr. Biggs ensures that small perks occur on a

regular basis. The company buys breakfast and lunch at least a couple times a month. Mr. Biggs allows employees the flexibility to take the morning off to enjoy a good snow day. He takes the entire company on rafting trips. The company has even purchased a condominium next to Coors Field in Denver for use by all the employees. Overall, Mr. Biggs makes PLC a great place to work.

Additional information on the company and its employees can be found in the journal located in Appendix A. The journal was kept for several reasons. The main reason was to provide a record on which to reflect back upon while preparing this record of study. It is not realistic to expect to remember everything experienced throughout an entire year. In addition to a memory jog, it provides support to the record of study's observations and recommendations by referring back to specific incidents. Perhaps a greater benefit to the reader is that the journal provides a personal look into the trials and tribulations of a military engineer attempting to integrate into a civilian company.

DUTIES AND RESPONSIBILITIES

Technical Aspects of the Internship: The author served as a site development engineer responsible for the CAD design in the areas of building topographic surfaces, grading, road plan and profile, and utility design. PLC primarily uses AutoCAD Land Desktop, version 6.0 for all of their designs. Teaching Air Force Academy courses only requires the use of AutoCAD Architectural Desktop. For this reason, it was necessary to spend the first month at PLC going through AutoCAD's tutorials. The lessons were somewhat helpful in providing the basics of civil design. However, most of the "real" learning came from struggling with the first two projects. It took time to understand the details required to complete a quality product. This struggle was aided by knowledge and the patience of the engineers at PLC. They helped by breaking down a number of difficult steps into smaller more manageable parts. The following list provides the project name and associated details of the major projects completed during the internship:

- Access Driveway for a Wastewater Treatment Plant, Wolcott, CO.

Objective: Prepare a plan and profile for a 1500 linear foot driveway accessing a wastewater treatment plant site from the I-70 frontage road.

Task Description: Using the topographic information from the survey conducted by PLS, a road profile was prepared to meet the Eagle County's grade requirements for a driveway. The difficult part came from a required railroad crossing. This portion of the driveway had to be designed to meet Denver Railroad specifications. Because of the crossing, culverts had to be designed to meet the necessary hydraulic flows on either side of the RR tracks. A hydraulic study of the site was required. The last items required by the client were to determine cut and fill on the site and the development of an effective erosion control plan.

Administrative Assignment: Prepared the necessary paperwork to meet Denver Railroad's real estate requirements. The documentation included the description of the project and associated changes based on the design. In addition, documentation to verify that all the railroad grade requirements were met.

Description of Nontechnical Problems: The only issue was to ensure water quality was not affected in the Eagle River which was directly adjacent to the project. Typical erosion control devices to include hay bales and silt fences were used.

Method: An initial map was prepared to provide the boundaries for the topographic survey. Because of the size of the watershed, peak flows for various storm events were determined from USGS topographic maps using the rational method and Hydro CAD. The software program FlowMaster was then used to size the required culverts. The engineering design was completed using AutoCAD Land Desktop.

Sources of Information to Perform Task: The sources include the *Urban Storm Drainage Criteria Manual* (USDCM 2001) and Eagle County's rainfall data (ECD 2006).

Discussion of Pertinent Information Not Readily Available: N/A

Consequences: This was the first major project assigned. As the result of being the engineer of record for the design, this was the first opportunity for the author to stamp a design. All of the major aspects of site design such as road profiles, grading and hydraulic design were covered by this project.

Contributions to Any Area Outside The Direct Assignment: The engineering design directly assisted with the development of the lesson plans for the Air Force Academy.

- Race City Building, Vail, CO.

Objective: Prepare a grading and site plan for a new 2500 sq ft facility at the base of the Vail ski area.

Task Description: Vail Resorts needed to replace an aging facility with no water or sewer services at the base of the Golden Peak ski area. The new facility's footprint exceeded the footprint of the existing structure. This new footprint encroached into an existing haul road. The design required a grading plan that minimized the cut and fill for the new building while also minimizing the grading resulting from moving the haul road approximately 15 feet to the north. In regards to the utilities, the locations were determined based on minimizing costs for new water and sewer services.

Administrative Assignment: Provide a preliminary site design to secure project approval by the Town of Vail's (TOV's) Design Review Board (DRB). Additional information was provided by Mr. Luna.

Description of Nontechnical Problems: Site design was constrained by the condition that no existing trees were to be removed. A large blue spruce in the southwest corner dictated the final finished grade of the structure.

Method: An aerial photograph using *teraserver.com* was used to provide a boundary for the topographic survey. The engineering design was completed using AutoCAD Land Desktop.

Sources of Information to Perform Task: The TOV's DRB application (DRBA 2007). The software program FlowMaster was used in sizing a drainage culvert.

Discussion of Pertinent Information Not Readily Available: The location of the existing utilities was not known. This delayed the completion of the design by several months. This is a common occurrence in the TOV. The town is working with all of the engineering firms to update their utility as-builts.

Consequences: The most valuable thing learned from completion of this task was the level of effort required to meet the DRB requirements. The design would have been less difficult if the DRB had allowed the removal of just one tree.

Contributions to Any Area Outside The Direct Assignment: This project was also used in the preparation of the AF Academy lesson plans.

- Streamside at Marriott Renovations, Vail, CO.

Objective: Provide a design for an emergency exit from the Marriott Resort main building and a design for the new entrance to the building.

Task Description: Working from a survey provided by PLS, a topographic surface using AutoCAD was prepared to lay out a profile/profile for a new stair and pathway from the back

exit of the Marriott building to meet new safety requirements for an emergency exit. The new egress had to cross two existing retaining walls while minimizing the amount of cut and fill. The building's new front entrance required the redesign of a new stairway that accessed the parking lot and building decks.

Administrative Assignment: N/A

Description of Nontechnical Problems: Site design was constrained by the condition that no existing trees were to be removed. Several trees dictated the final location of the path.

Method: An existing PLC drawing of the site was used to provide the boundaries for the topographic survey. The engineering design was completed using AutoCAD Land Desktop. The design was constrained by the requirement to match existing floor and sidewalk elevations.

Sources of Information to Perform Task: The *Uniform Building Code Compliance Manual (UBC)* (Parish 1999).

Discussion of Pertinent Information Not Readily Available: N/A

Consequences: The most valuable thing learned from completing this project dealt with the difficulty of matching existing finish grades coupled with the requirements of the UBC. Several iterations were used before the design was acceptable. Mr. Luna required the precision to be to the hundredths of an inch. This precision is required by surveyors when setting grade stakes. In reality, a contractor can not achieve that kind of precision. The use of the term, "field fit" came up in some of the discussions. This term allows the contractor some flexibility to adjust the final product.

Contributions to Any Area Outside The Direct Assignment: A common problem was identified in the initial stages of the design. The final topographic surface came from different surveys. This left several holes in the surface that required additional CAD work. Mr. Luna was able to use the project to highlight this common topographical problem to John Fee. Mr. Fee's staff is now required to resolve any surveying problem before providing the engineering staff with one complete surface.

- Miner's Creek Road – Creekside Drive Pathway and Road Project, Frisco, CO.

Objective: Provide a design for the construction of a new recreational pathway combined with the resurfacing and realignment of the adjacent roadway.

Task Description: Grant Anderson completed the actual profile and new surface for the pathway and road resurfacing. The extent of the encroachment had to be determined for the existing

driveways to meet grading requirements by the town of Frisco. A watershed area was adjacent to the project. This required the design to include measures that would not increase the discharge of any additional storm water. The final design had to be presented to the affected property owners. Each owner was granted the opportunity to discuss the limits of construction based on the design. For instance, one property owner might have an asphalt driveway that required complete reconstruction due to the new grade of the road while other property owners might only have a small portion of their driveway rebuilt. The last requirements included the redesign of two intersections, a demolition plan, the notes and details for the new grading plan, the erosion control plan, the contract documents, and the construction easements for each property owner.

Administrative Assignment: Individual exhibits for each affected driveway were prepared for approval from the Town of Frisco. An exhibit detailing the limits of construction was created for a town hall meeting.

Description of Nontechnical Problems: N/A

Method: Existing maps of the Town of Frisco were used to determine the boundaries of the survey. The engineering design was completed using AutoCAD Land Desktop.

Sources of Information to Perform Task: The software program FlowMaster was used in sizing a drainage culvert.

Discussion of Pertinent Information Not Readily Available: The final design could not be completed until the Town of Frisco received all public input regarding the limits of construction. This only affected the quantity of gravel or asphalt for each of the property owners' driveways.

Consequences: The most valuable lesson learned from this project was the importance of the layer manager within AutoCAD. Because of the individual exhibits for each driveway, a number of lines were needed to provide final drawings and estimates. Keeping track of all these lines was only possible through the use of the layer manager. After several trials, a system was developed that allowed easy access to any specific drawing.

Contributions to Any Area Outside The Direct Assignment: N/A

- The Canyons at River's Edge Condominiums, Vail, CO.

Objective: Prepare the civil design for the rebuilding of an existing five building condominium complex.

Task Description: The design required the development of the utility, demolition, and erosion control plans. In addition, the design had to ensure water quality was not affected in the Eagle River which was directly adjacent to the project. The use of typical erosion control devices to include hay bales and silt fences were used. Finally, Mr. Luna needed assistance in completing the grading design by determining the elevations of the existing entrances to each of the buildings.

Administrative Assignment: A gas and water exhibit had to be prepared for approval of local utility board.

Description of Nontechnical Problems: N/A

Method: An existing survey was used to identify the horizontal features of the project. The utility, demolition, and erosion control plans were completed using AutoCAD Land Desktop.

Sources of Information to Perform Task: Local utility company plans design specifications were used to determine gas line installation requirements.

Discussion of Pertinent Information Not Readily Available: N/A

Consequences: Completion of this project provided a look at some of the problems that arise when the architect and the engineer do not communicate effectively. Several grading designs had to be resubmitted based on the architect's changes. In addition, the existing survey was completed by another company that did not align the drawing with true north. This created several problems in maintaining the correct rotation of figures and text.

Contributions to Any Area Outside The Direct Assignment: N/A

- North Frontage Road Recreational Path, Vail, CO.

Objective: Provide a civil design for a new recreational path along I-70's North frontage road.

Task Description: A substantial amount of time was taken to determine the drainage area for the recreational path. HydroCAD was used to determine the flow rates for a 15, 25 and 50 year storm event. A model of the roadway was then created to determine the reach of maximum flows into the existing roadway. The actual design was completed by Mr. Baylosis.

Administrative Assignment: A preliminary hydraulic design was required by the TOV to ensure capacity and reach of the proposed project.

Description of Nontechnical Problems: The proposed path impacted an area used for snow storage during the winter. The TOV maintenance department was consulted to ensure a problem would not be created by the project.

Method: Existing TOV topographical information was used to determine the watershed affecting the proposed project. Field surveys located and verified the size and lengths of existing culverts and detention ponds. All the information was imputed into HydroCAD to create a preliminary drainage report.

Sources of Information to Perform Task: The sources include the *Urban Storm Drainage Criteria Manual* (USDCM 2001) and Eagle County's rainfall data (ECD 2006).

Discussion of Pertinent Information Not Readily Available: N/A

Consequences: The most important lesson learned was the impact of weather on projects in the mountains. Because the frontage road is owned by the State of Colorado, the project was delayed until the state could send a field engineer to survey the project site. This action had to be accomplished when there was no snow on the ground. Unfortunately, the project began in late November. The project was put on hold until the spring.

Contributions to Any Area Outside The Direct Assignment: The hydraulic study aided in the design of an adjacent property. Because the watershed of the new hotel project was within the existing boundaries of the pathway project, the hydraulic design required only slight modifications.

- Berry Creek Park Improvements, Edwards, CO.

Objective: Design a children's spray park within the existing limits of the park.

Task Description: Using information from a previous survey, the maximum size of the spray park was determined to allow construction within the existing constraints. The constraints included two pathways and a concrete pavilion. A site plan was designed to provide construction grades that minimized the cut and fill on the site.

Administrative Assignment: Several design options were prepared for approval from Edward's Park and Recreation Department.

Description of Nontechnical Problems: N/A

Method: An existing topographic surface completed in an earlier PLC project was used to develop a grading and site plan.

Sources of Information to Perform Task: The only source used in the design was the manufacturer's installation recommendations.

Discussion of Pertinent Information Not Readily Available: The project area was directly adjacent to an existing dirt parking lot. The lot was planned for paving within the next few

years. The grading design for the new water park had to assume a number of elevations and grades in order to complete the design.

Consequences: The most valuable lesson learned from this project was the importance of an accurate topographic surface. Because the proposal did not include a new survey, the design had to rely on the previous design and not an as-built survey. It is likely that the design will have to be modified once construction takes place.

Contributions to Any Area Outside The Direct Assignment: N/A

- As-builts for East Meadow Drive, Vail, CO.

Objective: Provide as-built drawings meeting Eagle River Water and Sewer District standards for several construction projects related to East Meadow Drive.

Task Description: This project was actually several years old. A district meeting was held to determine the requirements for the as-builts. After field verifying several features, several red line drawings were compiled and reformatted into one AutoCAD file.

Administrative Assignment: N/A

Description of Nontechnical Problems: N/A

Method: Information as-built information from the County's engineer combined with PLC as-builts for several projects were used to create a consolidated AutoCAD drawing.

Sources of Information to Perform Task: The only source used was the Eagle River Water and Sewer District requirements (ERWSDR 2007).

Discussion of Pertinent Information Not Readily Available: A number of valves were not field verified due to the amount of snow covering the ground. These valves were marked for verification during the spring.

Consequences: The most valuable lesson learned was the importance of completing as-builts as soon as a project is completed. Completing the as-builts several years after project completion leads to inaccurate data. In addition, it is not always advisable to rely on the contractor's as-builts. More accurate results come through field verification by the design engineer. Accurate as-builts can save a customer both time and money.

Contributions to Any Area Outside The Direct Assignment: The as-builts completed will be used for several decades to come as new projects are designed in the affective area.

- Surveys, Various Locations.

Objective: Provide survey support for PLS.

Task Description: Fieldwork was necessary to help survey lot boundaries, street profiles, topographic maps, and flood plain boundaries. In the office, AutoCAD was used to draw new plat boundaries for a 5000 acre private ski resort. In addition several surfaces were built from surveyed points for use by the other engineers in the office.

Administrative Assignment: N/A

Description of Nontechnical Problems: N/A

Sources of Information to Perform Task: N/A

Discussion of Pertinent Information Not Readily Available: N/A

Consequences: The most important lesson learned from this activity was the difficulties faced by the field survey crews. Mr. Biggs requires the crews to provide accurate measurements down to the hundredths of an inch. The crews know full well that contractors can never be expected to achieve that level of precision. In addition, surveyors are often the first people blamed when there is a problem in the construction or design. That is an enormous responsibility considering the stakes of a multi-million dollar project. Because of this, the survey crews spend a large portion of their time verifying the existing benchmarks. More time with the surveyors would have improved the internship experience.

Contributions to Any Area Outside The Direct Assignment: N/A

- Business Park, Edwards, Colorado

Objective: Provide site inspections for the widening of a frontage road adjacent to a new business development.

Task Description: The project involved the realignment of the I-70 south frontage for access into a new five acre commercial development. Because the road was an interstate right-of-way, a state highway engineer was the principal point of contact for major issues. The principal task was to ensure the contractor built to plan.

Administrative Assignment: This task required the completion of field inspection reports and necessary pictures for every day of observation.

Description of Nontechnical Problems: A local construction firm was hired by the owner to complete the project. Their project manager was very difficult to work with due to his inability to make any decisions on his own. Any questions had to be referred to Mr. Romeo Baylosis, the

project engineer. The back and forth communication was a bit frustrating at times, but necessary due to the experience required to ensure the best decision was made.

Method: N/A

Sources of Information to Perform Task: N/A

Discussion of Pertinent Information Not Readily Available: N/A

Consequences: The most valuable lesson learned from this experience was the importance of having a construction supervisor willing to make a field decision. Several minor issues were raised that resulted in delaying the project by several days. Because the construction supervisor would not make a decision, the engineer, Mr. Baylosis, had to come out to the site to address the problem.

Contributions to Any Area Outside The Direct Assignment: N/A

- The Pointe, Edwards, CO

Objective: Provide site inspections for the construction of a three acre residential site carved out of a hillside in Edwards, Colorado.

Task Description: Most of the inspections involved verifying the layout of the water and sewer services.

Administrative Assignment: This task required the completion of field inspection reports and necessary pictures for every day of observation.

Description of Nontechnical Problems: During one inspection, a concern was raised to Mr. Luna on the lack of physical protection for a trench dug to place a sewer manhole. The hole was at least 15 feet deep without any shoring. Mr. Luna indicated that PLC had no obligation for safety on the site. He acknowledged the problem, but said it was common practice in the area. This breach of safety would never be acceptable on a government project. However, this was not a government project.

Consequences: A licensed engineer has the obligation to report any safety concerns even if it is common practice to ignore them. Reporting the concerns may cost the contractor a fine, but could result in saving a worker from injury or death.

Contributions to Any Area Outside The Direct Assignment: The issue of a 15 ft trench without a retaining wall and the subsequent conversation with Mr. Luna would make an excellent case study for ENGR 482, Ethics and Engineering. This course used similar examples to demonstrate the responsibilities an engineer has to the safety of workers and the general public. What would

you do as a young intern or engineer if your boss told you not to pursue reporting a safety violation? Would you be more concerned about losing your job? These are just two questions could be used in a case study.

The last item inspected in Edwards was a retaining wall built for the construction of the access road. It was interesting to see that the outside wall only supported its own weight. The hillside was supported by a series of soil nails and geo-textile fabric. The wall was designed by a separate firm. In fact, PCE does not design any wall structures. As a great number of sites require retaining structures, this is one area where PCE has the opportunity to create more business.

- PLC Website Design

Objective: Build a website prototype for the company.
Task Description: Using information from PLC's marketing handouts and internal project documents, build a website using Microsoft PowerPoint.
Administrative Assignment: N/A
Description of Nontechnical Problems: The use of the internet as a marketing tool was presented and discussed in MKTG 621, Survey of Marketing and SCOM 665, Communication and Technology. This information was useful in developing a website that can be easy to use and navigate.
Consequences: The most valuable lesson learned was just how useful a website can be for marketing of a small engineering firm. Potential customers can be directed to the website to verify previous completed projects and experience of employees.
Contributions to Any Area Outside The Direct Assignment: An additional source of marketing can be utilized at little cost once the site is developed. Even securing one customer with the website will compensate PLC for the development.

Administrative Duties of the Internship: The only administrative aspect of the internship was the completion of a weekly timesheet. Microsoft Excel was used to complete this requirement. Because Air Force members are not required to track their working time, this was a new experience. However due to the non-paid aspect of the internship position, it was not necessary to be meticulous in tracking every minute spent on projects. Mr. Luna adjusted the client's billed time for a portion of the actual time spent as well as billing out at a much lower rate than

the other engineers. Because of this type of accuracy, the recorded time was rounded to the nearest hour. The other engineers are more precise in their timesheets. Everyone also tracks the time spent on phone calls and e-mails. Mr. Luna reconciles all of the timesheets each month to ensure no mistakes are made before preparing the client's invoices.

Managerial Duties of the Internship: The internship position provided no opportunity for managerial duties.

FINAL OBJECTIVES

The preliminary objectives were revised after the first few months on the job. As required by the Doctorate degree program, these objectives were discussed with and approved by the advisory committee at the six-month point of the internship. The following three objectives are taken from the final proposal:

Objective 1: Develop a Business Plan to build a similar size company offering services in Civil Engineering Land Development and Residential Architectural Development.

Specifically*:* The author intends to retire from the Air Force after serving 20 years. Upon retirement the author would like to start his own company in the Summit County area offering services in civil engineering and residential development. While working at PLC, the author was able to obtain a better understanding of what it takes to succeed in this type of business. Several questionnaires were developed for the staff of PLC regarding key areas of the business. The author hopes to gain insight on the following:

A. Actual
    1. Office space and equipment, computer hardware
    2. Type of software programs
    3. Surveying requirements (or outsourcing if possible)
B. The specifics on what it takes to hire quality people
    1. Education requirements
    2. Negotiation techniques
    3. Starting salary and benefits
C. The specifics on what it takes to keep quality people

1. Continuing professional education
2. Bonuses and promotion opportunities
3. Level of autonomy

D. The specifics on effective management of business and employees

1. Evaluation and promotion
2. Mentorship

In addition, questionnaires were developed for the town and county government planners and engineers. The author hoped to gain insight on the following:

- How to effectively compete for limited business
- The specific attributes of a "qualified" company
- The makeup and organization of a town and county engineering and planning board
- The process of qualifying for sole sourcing

This information will form the basics of the requirements needed to operate a successful business. These basics will then be incorporated into the preparation of a business plan that can be submitted to a lending source. There are numerous sources for writing plans. The author started the process with *Anatomy of a Business Plan: A Step-by-Step Guide to Building a Business and Securing Your Company's Future* (Anatomy of a Business Plan) (Pinson 2005). Upon preparation of the draft business plan, feedback was solicited from Patrick Mullane, a recent graduate of Harvard's MBA program.

The final step in the process is to determine possible lending sources. In order to accomplish this step, local lending sources, banks and credit unions will be solicited for an interview. In addition, a web search will be conducted for possible lending sources. The ultimate goal in this search is to verify that all of the requirements of the business plan are met.

Objective 2: Develop effective lessons to teach the basics of AutoCAD Civil 3-D design for the Air Force Academy.

Specifically*:* While teaching at the Air Force Academy from 2001 to 2004, the author noticed several areas of the civil engineering program that needed improvements to keep up with the changing technology in CAD and civil design software. The principal hindrance to change lies directly in the way the Air Force Academy fills its staff of instructors. With only a three-year

tour, new instructors spend the first year learning the essential basics of the course material. They do not have time to devote towards developing new lesson plans. Only a few of them have the opportunity to course direct in their second year. By the time they are course directors in their third year, most are encouraged only to make small changes in the lessons in order to help facilitate the learning curves of the new instructors coming into the Academy. Furthermore, the cadre of civilian instructors at the Academy tends to shy away from modifying their own lessons to keep up with changing technologies. A few professors have even stated that they are not willing to use CAD in their lessons because they are not familiar and do not want to be familiar with the CAD programs.

The goal is to develop lessons plans that the instructor can use in the two classes that primarily use CAD; Computer Applications for Civil Engineers and Architecture Design. The author course directed both these classes and feels confident that incorporation of the lesson plans is possible upon returning to the Academy. The author also contacted the current course director and has secured permission to teach these lesson plans in the Spring 2007 semester. The author would like to build lessons that would teach the following:

- The establishment of alignments and profiles in road design
- Building surfaces in CAD based on surveyed points and boundaries
- Determining cut and fill requirements for a civil project
- Using CAD to design vertical curves to meet design speeds and sight requirements

Objective 3: Using past experience in the Air Force and knowledge gained in pursuit of a DE degree, provide an objective review of the business and management practices of PLC.

Specifically*:* This is the one objective that will be the most difficult to write. There are many areas of the company that could be improved. However, there are some areas that are intentionally completed in a particular way based on the specifics of the company's internal goals. It is important to recognize these areas up front and not deal with them directly in the body of the objective review. The second problematic area deals with the difference between academic and practice techniques. The author has long recognized the difficulty in implementing suggestions based on a pure academic approach. This type of approach is defined as addressing a problem using only textbook references. Therefore, the author will attempt to first identify the academic reasoning behind a project management technique. From there, the

author will then provide a specific recommendation that can be implemented by PLC. At this point, the author will focus his efforts on the following areas:

- Overall management in relation to engineering staff
- Overall management in relation to surveying staff
- Overall management in relation to administration
- Project management techniques between engineers and clients
- Overall assessment of climate based on elements of human behavior

FORMAT OF PROCEEDING CHAPTERS

The following three chapters are broken down by each final objective: Preparation of a business plan for a similar company; preparation of lesson plans for use at the Air Force Academy; and a management review of the practices at PLC. Each chapter begins with an introduction describing the reasons for and the method used to prepare the actual product. References are made throughout each chapter relating how a specific Texas A&M University course aided in the completion of the objective. Finally, each chapter also contains additional background material used to create the actual products. Because of the format requirements for this ROS, the products are included in the appendix portion of this report. Each chapter concludes with reviews and comments for each one of the products.

CHAPTER II

BUSINESS PLAN FOR AN ENGINEERING/ARCHITECTURAL FIRM

INTRODUCTION

How do you succeed at establishing a professional service business in a relatively closed market? Where do you start? These were the two questions that needed answering to meet the first objective: "Develop a Business plan to build a similar size company offering services in Civil Engineering Land Development and Residential Architectural Development." As stated in the final objectives, the process began by reading Pinson's (2005) book entitled, *Anatomy of a Business Plan*. Pinson's (2005) book was straight forward in its approach to developing a plan. However, a second reference was used to ensure that all the basics were covered before beginning the business plan. The second reference chosen was *Business Plans: Create a Business Plan to Supercharge Your Profits* (Cagan 2006). Like Pinson (2005), Cagan's (2006) book presented a straight forward approach in the basic requirements in preparing a quality business plan.

METHODOLOGY

As stated, both Pinson (2005) and Cagen's (2006) books provided a great deal of background information on the specifics of a good business plan. This information was followed by examples of business plans based on different types of businesses such as service and product based companies. The author chose to begin the building of the business plan by first using the examples to construct a template of a service based business plan. The template chosen begins with an executive summary of the business. The template can be broken down into the following sections:

1. Organizational Plan
    a. Summary description of business
    b. Products and services
    c. Legal structure
    d. Management
    e. Personnel
    f. Legal and accounting
    g. Insurance and security

2. Marketing Plan
    a. Target market
    b. Competition
    c. Advertising
    d. Location
3. Financial Documents
    a. Summary of financial needs
    b. Loan fund dispersal statement
    c. Financial projections
    d. Projected balance sheet
    e. Breakeven analysis
4. Supporting Documents

Research was then conducted to fill in the necessary information for each specific part of the plan. The following discussion breaks down the plan in order of individual topics.

An important note must be made concerning the starting date for Summit A&E. Even though the author will not be able to start the business until after retiring from the Air Force, the business plan was constructed by assuming the business would start in January 2008. This was necessary to ensure the best possible estimates for expenses and revenues. In addition, it was necessary to secure the review of a local bank loan officer. It would be unrealistic to expect a loan officer to review a plan that was not going to be implemented until 2013. The loan officer was told after the interview began that the plan would not be implemented until 2013. The loan officer understood the reasoning and even asked the author to keep in touch over the next few years. The author's intent in completing this objective was to determine the feasibility of starting a similar business in a mountain resort town. The author understands that the business plan will need to be updated at the point in which the author is able to retire and can start the new business.

- Executive Summary

One of the most important pages of the business plan is the executive summary. This page provides the reader a snapshot of the overall business and associated needs of the business. Following the guidance in Pinson (2005) and Cagen's (2006) books, the author choose to first

provide the reader with the basics of the company to include the name of the company, how the company is organized and the specific location of the office. In addition, the introductory paragraph states the specific amount of money that was needed and the purpose for the money. For the author's proposed plan, the information is as follows:

Name of Company: Summit Architect & Engineering LLC. The name of the company was chosen to represent both of the primary services offered to the client. The designation of LLC indicates the company is to be incorporated as a Limited Liability Company. The LLC was chosen to protect the owners' personal assets from lawsuits or judgments against the business. Each owner's liability is limited to the amount each has invested in the company. A company logo was designed and is shown in Figure 2.

Figure 2: Company Logo

Location of Company: The location of the main office was chosen to be on Main Street in Breckenridge, Colorado. This location provides excellence visibility due to the numerous potential clients vacationing in the Breckenridge Ski Area. Main Street contains the majority of restaurants and shops within the town limits. The author learned the importance of this kind of marketing strategy in part through lessons taken while in MKTG 621, Survey of Marketing. This course emphasized the need to ensure your product was as visible as possible. In addition, the course stressed the importance of knowing your customer base. The majority of potential clients in Summit County first spend time in the area before purchasing or constructing a second home.

Management: The second paragraph provides the reader with a look at the how the company is to be managed as well as a short biography of the management staff. It is important to show the reader that the management has the necessary experience to succeed in the business. For the author's proposed plan, the information is as follows:

Summit A&E will be managed by its two principals, Eric Waters and Lance Weatherton. Mr. Waters has 14 years experience as a civil engineer in the Air Force and Mr. Weatherton has 14 years experience as an architect in residential and commercial design in Arkansas.

Current & Projected Market: The next paragraph provides a look at the current and projected market in which the new business will operate. Again, MKTG 621 provided insight in the importance of identifying the most likely customers for a successful business. For the author's proposed plan, the information is as follows.

It is important to show that the business can survive in the current and future market. For Summit A&E, the author relied solely on the Summit County Housing Needs Assessment (SCHNA 2005). This assessment provided a reasonable look into the trends affecting housing needs in Summit County. Similar sources can be found by searching the web for most communities. Other potential sources of information include local building association records or records from the local chamber of commerce. Summit A&E chose to pursue larger residential construction needs of $500,000 or greater. Summit A&E's current market projections come directly from the Summit housing assessment that indicates double digit growth over the past 10 years and a project demand of over 500 new housing units priced over $500,000 dollars by the year 2010.

Loan Repayment: The last paragraph in the executive summary addresses the terms of the loan repayment. Both Pinson (2005) and Cagen (2006) stress the importance of adding this information to any executive summary. For the author's proposed plan, the information is as follows:

Summit A&E chose to seek a loan for $150,000 on a 15-year payment plan. Combined with $50,000 in equity, the distribution of funds include $72,000 in equipment and furniture, $48,000 in operating expenses shortfalls, $19,200 in loan payments, and $62,500 in payroll reserves. The length of repayment can vary depending on a number of factors to include credit history of the borrowers and loan amount. Upon approval of the loan from a lending institution, the business

plan will be updated if the terms and the amount are different. Additional information on the first payment and method of securing the loan should also be presented in the executive summary. Summit A&E intends to begin repayment within 30 days of receipt. Summit A&E plans to secure the loan with the Principals' current real estate equity valued at over $300,000.

- Organizational Plan

The first part of the organizational plan is the summary description of the business. This is the area in which the author is given the opportunity to present the mission statement, the business model and strategy that the company will follow in order to succeed. These statements are intended to first differentiate the proposed business from its competitors and then describe the method in which the business will continue to grow. A great deal of thought must be made in putting these brief statements together. Without a clear and concise plan for the business, a lending source would be hard pressed to trust its resources to the new business. For the author's proposed plan, the information is as follows:

Summit A&E's Mission Statement: To establish a strong reputable firm that combines the professions of architecture and engineering to provide a complete service to our customers.

Summit A&E's Business Model: Summit A&E provides a cradle to grave approach for residential and commercial development by assisting the client through all phases of the design, engineering, and construction saving the client time and money.

The business model was influenced by both the time spent by the author as an intern at PLC and the business model used by PLC. The author was involved in several projects in which conflicts between the architect and engineer led to lengthy delays and increased costs to the client. Combining architectural and engineering services would eliminate these types of conflicts. This theory was validated by the success of PLC's business model of combining engineering and surveying services. PLC was able to save the client time and money through close coordination of these two services.

Summit A&E's Strategy: Summit A&E will seek several large residential construction projects during the first years of business. During this time, the company will also accept clients in need

of only civil engineering or architectural services. As the company's reputation grows, the company intends to move entirely towards clients in need of all services.

Products and Services: The next part of the organizational plan is to provide more details of the products and services offered by the company. If the company was selling a product, this is the area in which all the specifications and uses of the product would be given. As a service company, additional information is provided in Summit A&E's business plan to clarify that the company will manage in-house any subcontractors required to provide needed services to include landscaping, structural and/or geotechnical design. The plan continues by providing a profile of the two types of clients to be serviced. These clients are residential homeowners with home values over $500,000 and commercial developments of 20,000 sq ft or less.

Legal Structure: The organizational plan's legal structure is a key ingredient in determining how the company intends to grow. Various different structures are available for use. The business plan only presents a summary of the important facts to include provisions for exit and dissolution of the company. This section of the plan can also contain information concerning the possibility of selling shares to employees. Vesting employees into the success of a business is a topic discussed in MGMT 630, Behavior in Organizations. It is an effective tool when the company cannot afford to lose a well-trained employee and can not pay higher wages. However, the original owners must be fully aware of all the outcomes associated with this action. The entire structure of an organization can be changed with the selling of shares to employees. For the author's proposed plan, the information is as follows.

Initially, Summit A&E will be based on a 50 percent ownership of 500 total shares of stock split between the two Principals. The 500 number was chosen based on $50,000 divided by 100 per share. Summit A&E will not issue any new stock for a period of five years. This decision was based on the assumption that Summit A&E will need a minimum of five years to determine the success of the business. During that period, each Principal will still have the option of selling his stock to the other at the fair market value as determined by standard accounting principles. At the end of the five year period, the stock holders will evaluate the company to access the capability of expanding the business. Additional stock may be issued to employees or outside investors if expansion is agreed upon. From the five year point, bi-annual stock holder meetings will be held in January to determine by majority if the business will

expand and if new stock should be issued. No dividends will be issued for the first three years. All retained earnings shall be applied to repayment of the initial loan. After three years, dividends will be paid out based on 25 percent of the company's profits for that year. One of the overall goals of the company will be early repayment of the initial loan. The stock holders will take this goal into account in future discussions on business expansion. A life insurance policy in the amount of $250,000 shall be taken out in each original Principal to be paid out to the other Principal in the event of a Principal's death.

Management: Additional details on the management of the company are necessary to ensure the business is successful. However, it is not necessary to provide a great number of details. Details concerning education, years of experience and major accomplishments are more than enough to convey a positive message. The supporting documents section of the business plan will contain the resumes of the management.

Personnel: Another critical part of planning a business is to decide on the number and salaries of the personnel. Research should be conducted to determine comparable wages in the area. Other areas to consider are the availability of qualified employees, cost of living and employee incentives and benefits. As with all items, any changes in actual salaries paid should be updated in the business plan. The last item to address is the duties of the employees. This can also help in determining the salaries. It also shows potential investors that the Principals are not taking on too much work during the critical start-up years of the company. For the author's proposed plan, the information is as follows.

Summit A&E will have four full-time employees to include an architect, an engineer; an AutoCAD technician, and an office manager. The architect and engineer will receive a salary of $75,000 per year while the AutoCAD technician and office manager will receive $50,000 per year. The salaries are based on comparable wages in Summit County for employees in similar jobs. In determining these salaries, the author understands the importance of ensuring that the Principals and employees be adequately compensated. MGMT 630 stresses the importance of motivation coming after an individual's personnel and safety needs are met. A business is unlikely to succeed if the management and employees are more concerned on meeting personal financial needs.

Legal and Accounting: With a small service based business, the legal and accounting portion of the organization plan is simple to address. The only requirement is to show a lender that the business has a lawyer on retainer in the local area. In regards to accounting, a number of off-the-shelf bookkeeping software packages are available. Summit A&E chose QuickBooks Pro and Microsoft Office.

Insurance and Security: The final part of the organizational plan is to discuss the business's insurance and security. A local insurance agent will provide all the necessary details to provide a lender with a concise understanding of how the business will be protected from any liability. The choice of coverage is left to the owner. Summit A&E based its insurance coverage on the same coverage obtained by PLC.

A number of security measures are required for even a small firm. Internal databases and networks must be protected. The principals will perform background checks on potential employees. Finally, the building should contain at least an alarm.

- Marketing Plan

The second major section of the business plan is the marketing plan. Completing this section of the plan required the author to answer the five fundamental questions of any marketing strategy. These questions are:

1. WHO (are your customers? are your competitors?)
2. WHAT (are you selling?)
3. WHERE (is your target market?)
4. WHEN (will your customers buy?)
5. HOW (will you reach your customers?)

All of these questions were addressed in detail in MKTG 621, Survey of Marketing. The success of a business can be affected if even one of these questions is not properly considered. In the case of a service based business, the information required to answer these questions is easy to obtain. The local chamber of commerce is one of the first places to start the investigation. The chamber has a wealth of information on local businesses to include sales receipts for the area, population statistics, growth estimates, and links to other local business associations. A second source of information is the internet. Searching the internet for similar businesses will provide

several leads to additional sources of information. The final step in the process is to organize the information into the business plan in a manner that can be easily followed. Summit A&E's business plan separates the information into the target market, competition, advertisement, and location.

Target Market: Summit A&E identified its two primary customers, residential and commercial. On the residential side, the profile of the typical customer was based on a professional in the age range of 35 to 60 who is in the upper income bracket and seeking a second home in the mountains. The number of potential customers is based on data collected from the Summit County Housing Needs Assessment (SCHNA 2005). Based on the assessment, the author determined the number of new clients by the year 2010 to be in the range of 500 to 600.

On the commercial side, the profile of the potential customers included strip malls of less than 20,000 sq ft, remodels of existing stand alone structures, and municipal facilities under 10,000 sq ft. The potential number of commercial clients is increasing to meet the needs of an additional 18 percent increase in population in Summit County by the year 2010 as estimated in the Summit County Needs Assessment (SCHNA 2005).

Competition: The competition can be determined by first using the phone books to determine the number of competing business. Another source of information is the local business directory from the chamber of commerce. Some of the businesses must be contacted directly to determine the extent of the services they offer. In addition, it is important to determine the actual size of the company. A number of companies in small mountain communities are sole proprietorships. Summit A&E will not have any competitors that offer all three services of architectural design, civil design and project management for residential and commercial development. However, Summit A&E has to compete with firms that offer one or more of the services. There are 15 established architectural firms and four established civil engineering firms in Summit County.

Advertisement: Reaching your customers is a need for success. A small business must maximize its advertisement to reach many customers on a limited budget. The first step is to advertise in the local phone directory. A small ad in the phone book is inexpensive and effective. Local newspapers are a second source of advertisement. In Summit County, because the local paper is both free and full of advertisements of events and activities, it is read by a large

percentage of visitors to the area. Another source of advertisement is through real estate magazines. These magazines are also free in Summit County. All of these advertisements can include a reference to a company website. The website is a good place to showcase the capabilities of the business. Development and maintenance is inexpensive with the use of Microsoft FrontPage. Summit A&E used all of these sources of print media in its marketing plan. All cost for advertisements are based on ad rates published in each media.

It is also important to recognize other sources of advertisement outside the print media. Membership in the local Chamber of Commerce and business associations provide a good opportunity to meet new clients.

Location: The benefits of the business being visible to potential clients has already been addressed. However, it is important to expand on this aspect in the marketing plan. Additional information on the layout of the office can provide the reader a picture of how the business will handle interaction with its clients. Summit A&E intends to center interaction with clients in a large and inviting conference room equipped with the latest in presentation technology.

- Financial Documents

This section of the business plan allows the owners to explain all of the financial aspects of starting the new business. It is important to recognize that the numbers used in this section are just estimates. Several items such as furniture and equipment can be very close to the actual price. However, operating expenses are often based on estimates from similar businesses. Lenders understand this fact. They do require that the business plan be updated periodically to ensure the business is still capable of supporting itself. Based on the chosen template, Summit A&E chose to present a summary of financial needs, a loan dispersal statement, cash flow statements, three year income projection, projected balance sheets, and a break-even analysis. FINC 635, Financial Management for Non-Business and ACCT 640, Accounting Concepts and Principles provided an excellent background in preparing these items. These courses presented all the financial aspects and accounting principles of a running a business.

Summary of Financial Needs: The first item required in the plan is to reiterate how much the company is seeking. This simple statement sets the stage for the rest of the financial section. Summit A&E has $50,000 in equity and is seeking a loan for an additional $150,000.

Loan Fund Dispersal Statement: It is important to show how the funds will be spent. The exact categories used to describe the dispersal depend on the type of business. For Summit A&E, the first items in the statement included equipment and furniture costs. These numbers were determined by first using the requirements for running an engineering firm discovered during the employee interviews at PLC. Prices for the requirements were then obtained via the web. An additional 20 percent markup was added to account for items such as shipping and handling. The operating expenses shortfall came from the cash flow statements. The loan payments were broken out for the purpose of reassuring the lender that the business considered the loan payments as a high priority. The last item Summit A&E chose to present was a payroll reserve. This allows a buffer to ensure employee payments even if the business does not perform as expected.

2008 Pro Forma Cash Flow Statement: As with the general template for the business plan, a template from Pinson's book was used to create a cash flow statement. The template had to be modified to account for the specifics of operating Summit A&E. An Excel spreadsheet is a good media for building the statement. It allows easy manipulation of the numbers. The statement is separated into cash receipts and cash payments.

The cash receipts for Summit A&E include only the fees collected for services provided by the architect, engineer, and AutoCAD technician. Because the business is planned to start on 1 January, 2008, no fees are shown for the months of January to March. This is standard for a new business. Clients are typical allowed 60 to 90 days to pay for services.

The next step in the process is determining a realistic forecast of the company's receipts. A forecast is based on the market conditions of the area. The business plan has shown a potential market of over 500 homes priced over $500,000 by the year 2010 (SCHNA 2005). A business must then determine how much of the market the company will be able to capture. The author relied on his time spent at PLC, his seven years of experience in the local real estate market, interviews with local architects, and interviews with Mr. Weatherton in determining the level of business Summit A&E would most likely achieve.

During his time at PLC, the author witnessed several occasions in which PLC turned away new business. The majority of this new business came from local architectural firms. The

author learned that several of these projects were completed outside the local area. The lack of local firms to complete new projects is a good indicator for potential growth at Summit A&E.

The author's experience in real estate in the local area also indicated the potential for growth. The author purchased a condominium in Summit County in 2003. While looking for the property, the author conducted a great deal of research into the local area. All the indicators showed that Summit County was in the middle of a construction boom. The property has increased over 150 percent in value over the past three years. This is just one indication of supply not keeping up with demand. Two additional factors concerning the supply and demand curve were pointed out in the local media. First, the local area experienced a shortage in rental properties. This shortage drove up rental prices. Higher rental prices are encouraging second home owners to purchase or build new seasonal rentals in the area. Second, there is a shortage in housing for new residents. Even with the addition of several new subdivisions, the local construction industry is having a difficult time meeting this increased need.

One of the best sources of information on the architectural needs of the area came from Kathy Helmers, the office manager for Fritzlen and Pierce Architects in Vail, Co. The author interviewed Mrs. Helmers several times over the past year. She stated that Fritzlen and Pierce has been unable to keep up with the requests for new residential designs. The firm has added a number of new employees to help alleviate this problem. Mrs. Helmers stated that a small business like Summit A&E would have no problem securing new clients. She also indicated that she would have no problem referring business to Summit A&E.

The last source of information on the forecast came from Mr. Weatherton. His 14 years as an architect proved to be valuable in determining factors such as rates for services, project construction times, and typical breakdown percentages of employees during the life cycle of a project.

With all this background and supporting information, the author began the forecast by building a chart to indicate the hours and fees for typical projects ranging from $600K to $2.5M. Table 1 shows that for a $1M project, the total fee based on a 15 percent fee is $150K. The breakdown of hours is 300 hours for the architect, 550 hours for the engineer, and 700 hours for the AutoCAD technician. The fee percentage and hours were provided by Mr. Weatherton. The higher fee of 15 percent for residential projects over $1M compared to 12 % for residential projects under $1M is typical for the industry. Projects over $1M incur more cost in design,

redesign, and construction management. The author assumed a construction period of 13 months for projects under $1M and 24 months for projects over $1M.

Table 1: Project Data

	Project Cost (x 1000)					
	600	700	850	1000	1500	2500
% Fees	0.12	0.12	0.12	0.15	0.15	0.15
Total Fees	$72,000	$84,000	$102,000	$150,000	$225,000	$375,000
Project length mo	13	13	13	24	24	24
Architect hours	165	180	200	300	450	850
Engineer hours	275	325	400	550	850	1400
AutoCAD Tech. hours	300	350	450	700	1000	1600
Total billed	$72,550	$83,600	$101,750	$149,000	$222,500	$376,000

The next step was to estimate the amount and award date for new projects. This information is shown in Table 2. Based on the expenses of the firm, the author estimated that the firm needed to bring in over $2.0M in projects per year to be profitable. During the first year, the author assumed Summit A&E would be able to secure a number of projects priced under $1M. Table 2 shows Summit A&E beginning the year with a $1M project followed by four additional projects in 2008. In order to achieve these numbers, Summit A&E intends to solicit business six months prior to opening its doors in January. During this time the author will be in terminal leave status from the Air Force. This status allows the author to focus on capturing new business. In addition, Mr. Weatherton intends to be actively involved in the process. Although working full time with an architectural firm in Arkansas, he has been able to complete a number of projects on his own time. These projects include work in Aspen, Colorado and Cozumel, Mexico. After a year, the author assumed the business would be able to capture a $1.5M project. The author's final assumption was that the firm would begin a $2.5M project in October 2009. No additional work is shown for 2010. Under these projections, Summit A&E does not have the manpower to handle any additional work. However, Summit A&E will need to begin to solicit new work towards the end of the 2010.

Table 2: Project Award Data

Project Start	**Jan 08**	**Feb 08**	**Mar 08**	**Apr 08**	**Sep 08**	**Jan 09**	**Apr 09**	**Oct 09**
Project Cost	$1M	$850K	$700K	$600K	$1M	$1.5M	$1M	$2.5M

The author continued the process by estimating the percentage of time spent by the architect, engineer, and AutoCAD technician based on the overall project schedule. The data is shown in Table 3. An architect working on a 13 month project will spend 60 percent of his time during the first 4 months of the project.

Table 3: Project Schedule Data

	13 mo. Schedule		24 mo. Schedule	
	# mo.	%	# mo.	%
Architect	1 - 4	0.6	1 -6	0.6
	5 - 8	0.3	7- 13	0.3
	9 - 13	0.1	14 - 24	0.1
Engineer	1 - 4	0.3	1 -6	0.3
	5 - 8	0.3	7- 13	0.3
	9 - 13	0.4	14 - 24	0.4
AutoCAD Tech.	1 - 4	0.2	1 -6	0.2
	5 - 8	0.7	7- 13	0.7
	9 - 13	0.1	14 - 24	0.1

The next step was to break down the number of billable hours by employee and project over the period from January 2008 to December 2010. Table 4 shows the business starts out slowly in 2008 as the company adds new clients. The table also shows that the architect and engineer will have the hours necessary to focus on marketing the business during these crucial first months. The primary goal for breaking the hours down by month and employee was to determine the amount of business Summit A&E would be able to handle. The author ensured the hours exceed the capabilities of the firm assuming a 40 hour work week.

Table 4 shows the AutoCAD technician becomes extremely busy with 224 hours in October. This number is a little misleading. The engineer and architect are capable and have the time to assist with the AutoCAD requirements during this time. However, the number of hours remains in the AutoCAD row because the client will only be billed at the AutoCAD technician rate of $75 per hour. Determination of these rates was the next step. In addition to the AutoCAD technician rate, clients will be charged $120 per hour for architectural services and $110 per hour for engineering services.

Table 4: 2008 Project Hour Distribution

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Architect hours				30	60	87	112	112	97	66	53	83
Engineer hours				28	58	82	103	103	103	99	99	127
AutoCAD Tech. hours				23	46	64	78	78	134	224	259	282

The final step is to determine the estimated sales receipts for the architect, engineer, and AutoCAD technician by multiplying the specific rates by the corresponding number shown in Table 4. Table 5 shows a sample calculation for the month of April, 2008. The estimated sales receipt for April at $8,405 is shown in Figure 3 along with the rest of the sales receipts for January through April 2008. The sales receipts for the months of May through December 2008 are shown in Figure 4. In summary, Summit A&E is estimated to begin making a profit during the month of July 2008 with sales receipts of $30,620. Finally, Summit A&E is estimated to end 2008 with a cash balance of $51,674.

Table 5: Sample Calculations

	Apr-08		
	# hrs	rate	# hrs x rate
Architect hours	30	$120	$3,600
Engineer hours	28	$110	$3,080
AutoCAD Tech. hours	23	$75	$1,725
Total Sales Receipts:			$8,405

2008 Pro Forma Cash Flow Statement

Summit A&E Inc.

January through April

For the Year 2008	JAN	FEB	MAR	APR
BEGINNING CASH BALANCE	200,000	100,317	72,634	44,951
CASH RECIEPTS				
A. Sales Receipts				8,405
1. Architectural Fees				3,600
2. Civil Engineering Fees				3,080
3. AutoCAD Tech Fees				1,725
B. Interest Income	0	0	0	0
C. Sale of long-term assets	0	0	0	0
TOTAL CASH AVAILABLE	200,000	100,317	72,634	53,356
CASH PAYMENTS				
A. Variable expenses				
1. Marketing	1,000	1,000	1,000	1,000
2. Bonuses	0	0	0	0
3. Travel expenses	300	300	300	300
4. Miscellaneous	200	200	200	200
5. Furniture/Equipment	72,000			
Total variable expenses	**73,500**	**1,500**	**1,500**	**1,500**
B. Fixed expenses				
1. Administrative fees - legal/acct.	50	50	50	750
2. Insurance	950	950	950	950
3. Office Salaries	20,833	20,833	20,833	20,833
4. Rent expense	1,500	1,500	1,500	1,500
5. Utilities	250	250	250	250
6. Vehicle lease	800	800	800	800
7. Miscellaneous admin expense	200	200	200	200
Total fixed expenses	**24,583**	**24,583**	**24,583**	**25,283**
C. Interest expense (vehicles, equipment)	0	0	0	0
D. Interest expense (land and building)	0	0	0	0
E. Federal income tax				
F. State income tax				
G. Capital asset purc, cash (land and building)	0	0	0	0
H. Capital asset purc, cash (vehicles, equipment)	0	0	0	0
I. Loan repayment	1,600	1,600	1,600	1,600
TOTAL CASH PAID OUT	**99,683**	**27,683**	**27,683**	**28,383**
CASH BALANCE/DEFICIENCY	100,317	72,634	44,951	24,973
LOAN TO BE RECEIVED				
EQUITY DEPOSITS				
ENDING CASH BALANCE	**100,317**	**72,634**	**44,951**	**24,973**

Figure 3: Cash Flow Statement for January through April

2008 Pro Forma Cash Flow Statement

Summit A&E Inc.

May through December

MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
24,973	14,170	10,597	13,384	16,171	21,358	29,285	38,277
17,030	24,260	30,620	30,620	33,020	35,610	36,675	45,080
7,200	10,440	13,440	13,440	11,640	7,920	6,360	9,960
6,380	9,020	11,330	11,330	11,330	10,890	10,890	13,970
3,450	4,800	5,850	5,850	10,050	16,800	19,425	21,150
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
42,003	38,430	41,217	44,004	49,191	56,968	65,960	83,357
1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
0	0	0	0	0	0	0	4,000
450	450	450	450	450	300	300	300
200	200	200	200	200	200	200	200
1,650	**1,650**	**1,650**	**1,650**	**1,650**	**1,500**	**1,500**	**5,500**
50	50	50	50	50	50	50	50
950	950	950	950	950	950	950	950
20,833	20,833	20,833	20,833	20,833	20,833	20,833	20,833
1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
250	250	250	250	250	250	250	250
800	800	800	800	800	800	800	800
200	200	200	200	200	200	200	200
24,583	**24,583**	**24,583**	**24,583**	**24,583**	**24,583**	**24,583**	**24,583**
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
27,833	**27,833**	**27,833**	**27,833**	**27,833**	**27,683**	**27,683**	**31,683**
14,170	10,597	13,384	16,171	21,358	29,285	38,277	51,674
14,170	**10,597**	**13,384**	**16,171**	**21,358**	**29,285**	**38,277**	**51,674**

Figure 4: Cash Flow Statement for May through December

Cash payments shown in Table 3 and Table 4 are separated into variable and fixed expenses. Variable expenses include marketing, bonuses, travel expenses, and miscellaneous. The marketing expense at $1000 per month is the total based on the print ads and website costs presented in the Marketing section of the business plan. Summit A&E intends to provide a Christmas bonus of $2000 to the office manager and AutoCAD technician. The travel expenses are based on fuel and maintenance costs for two vehicles. The author assumes a value of $300 per month for October through April and $450 per month for May through September. The difference is due to the higher mileage expected during the summer construction season. A $200 per month expense for miscellaneous items is assumed by the author. This cost is intended to cover a basic petty cash fund to cover small expense items.

Fixed expenses include administrative fees, insurance, salaries, rent, utilities, and office salaries. The administrative fees cover the legal and accounting aspects of the business. The author assumes $50 per hour charge for discussion with a lawyer or accountant. This rate is based on PLC's current rate charge by its lawyer and accountant. The author includes a one hour a month charge for the company to address miscellaneous questions. During the month of April, the author assumes the company will need at least 15 hours of administrative fees to cover submitting the company's taxes to the Internal Revenue Service. The $950 per month insurance premium is discussed in detail in the organizational plan of the business plan. This number is directly based on PLC's cost. A slight decrease was made to account for a lower number of employees covered by the worker's compensation. However, the bulk of the costs were due to the coverage limits and deductibles. Office salaries of $20,833 per month were based on the company's stated intention to pay the two Principals a yearly salary of $75,000 and a yearly salary of $50,000 for both the office manager and AutoCAD technician. The rent expense of $1500 a month was assumed based on reviewing the actual rent costs in the local papers. The $1500 was a typical average for a similar size rental of 1500 sq ft. Utilities were estimated based on the author's own utility costs of an 1800 sq ft condominium in Breckenridge. The $250 per month cost covers gas, electric and phone. Water, sewer and trash are covered in the rent. The vehicle lease of $800 covers the leasing of two vehicles for the company. The author assumed this cost based on local ads of automobile dealers. The miscellaneous expense of $200 per month is intended to cover the basic office supply needs of a small company. It does not include office supplies billable to clients.

The only other expenses to the company come from taxes and interest payments on the initial loan. Summit A&E is a LLC but intends to be taxed as a corporation. This option of a LLC allows the company to take advantage of lower tax rates. If the company allowed the Principals to be taxed on the profits in addition to their salaries, retirement pay, and investment earnings, the tax rate for just the profits would be at least 34 percent. Based on information gathered from the internet (LCC 2007), the federal tax rate for a LLC that chooses to be taxed as a corporation is 15 percent for the first $50,000 of profit, 22.5 percent for profits up to $335,000, and 34 percent for anything higher. State and local taxes are 8.275 percent for the town of Breckenridge. This information is from the website of the Summit County Assessor's office (SCTR 2007). The tax amounts shown in the cash flow statements are determined by first computing the profits for the company during the calendar year. The tax amount is then divided into four quarterly payments for that year.

The interest payment for the initial loan of $150,000 is $1600 per month. This is based on a 10 percent annual percent rate on a 15 year loan. The 10 percent rate is based on the current average charged for a small business loan as indicated in the interview with a Wells Fargo loan officer.

Three Year Income Projection: Excel spreadsheets were built for the first three years of the business. It is important to note that the author chose not to adjust any income or expenses due to anticipated inflation. All of the financial data used in the spreadsheets are considered to be estimates. The very small changes in amounts due to inflation would not add any more significant information to the plan. Updates to the business plan are intended and required by the lending institution. It is during these updates that more accurate information can be used to verify and revise the business plans projections.

Summit A&E's three-year income projection can be found in Figure 5. As expected, Summit A&E operates at a loss for the first year. By year three, Summit A&E achieves an estimated $82,300 in profits.

Three-Year Income Projection
Summit A&E

	YEAR 1	YEAR 2	YEAR 3	TOTAL
INCOME				
A. Sales Receipts	261,320	438,960	495,870	1,196,150
1. Architectural Fees	84,000	121,920	122,640	328,560
2. Civil Engineering Fees	88,220	179,190	196,680	464,090
3. AutoCAD Tech Fees	89,100	137,850	176,550	403,500
B. Interest Income	0	0	0	0
C. Sale of long-term assets	0	0	0	0
GROSS PROFIT	**261,320**	**438,960**	**495,870**	**1,196,150**
EXPENSES				
A. Variable expenses				
1. Marketing	12,000	12,000	12,000	36,000
2. Bonuses	4,000	4,000	4,000	12,000
3. Travel expenses	4,350	4,350	4,350	13,050
4. Miscellaneous	2,400	2,400	2,400	7,200
B. Fixed expenses				
1. Administrative fees - legal/acct.	1,300	1,300	1,300	3,900
2. Insurance	11,400	11,400	11,400	34,200
3. Office Salaries	249,996	249,996	249,996	749,988
4. Rent expense	18,000	18,000	18,000	54,000
5. Utilities	3,000	3,000	3,000	9,000
6. Vehicle lease	9,600	9,600	9,600	28,800
7. Miscellaneous admin expense	2,400	2,400	2,400	7,200
8. Depreciation (assets)	9,600	9,600	9,600	28,800
Total operating expenses	**328,046**	**328,046**	**328,046**	**984,138**
NET INCOME	**-66,726**	**110,914**	**167,824**	**212,012**
Other Income (intereset income)				
Other Expense (intereset expense)	19,200	19,200	19,200	57,600
NET PROFIT (LOSS) BEFORE TAXES	**-85,926**	**91,714**	**148,624**	**154,412**
Federal Taxes		18860	31,848	50,708
State Taxes		8312	13,092	21,404
NET PROFIT (LOSS) AFTER TAXES	**-85,926**	**64,542**	**103,684**	**82,300**

Figure 5: Three Year Income Projection

Projected Balance Sheet: The balance sheet allows a reader to easily see the business's assets, liability, and equity for a particular point in time. Figure 6 shows Summit A&E's balance sheet for January 1, 2008. Figure 7 shows Summit A&E's projected balance sheet for December 31, 2010. The information indicates that Summit A&E increases the shareholders' equity into the company from an initial value of $50,000 to $167,650 over the course of three years. This

amount may not seem to be a large increase, but it does indicate the business is expected to be able to pay all its expenses and still remain profitable.

Business Name:

Summit A&E Inc. Projected for: January 1, 2008

ASSETS			% of assets
Current assets			
Cash		128,000	64.00%
Petty cash		0	0.00%
Accounts receivable		0	0.00%
Inventory		0	0.00%
Short-term investments		0	0.00%
Long-term investments			
Fixed assets			
Land (valued at cost)		0	0.00%
Buildings			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Improvements			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Equipment		54,000	27.00%
1. Cost	54,000		
2. Less acc. depr.	0		
Furniture		18,000	9.00%
1. Cost	18,000		
2. Less acc. depr.	0		
Autos/Vehicles		0	
1. Cost			
2. Less acc. depr.		0	
TOTAL ASSETS		**200,000**	**100.00%**

LIABILITIES		% of assets
Current liabilities		
Accounts payable	0	
Notes payable	0	
Interest payable	0	
Pre-paid deposits	0	
Taxes payable		
Accrued federal income tax	0	
Accrued state income tax	0	
Accrued payroll tax	0	
Accrued sales tax	0	
Payroll accrual	0	
Long-Term Liabilities		
Notes payable to investors	150,000	
Notes payable to others	0	
TOTAL LIABILITIES		
NET WORTH (EQUITY)		
Corporation		
1. Capital Stock		
2. Surplus paid in		
3. Retained Earnings	50,000	
TOTAL NET WORTH	50,000	

Figure 6: 2008 Balance Sheet

Business Name:

Summit A&E Inc. Projected for: December 31, 2010

ASSETS			% of assets
Current assets			
Cash		236,850	78.26%
Petty cash		1,000	0.33%
Accounts receivable		31,000	10.24%
Inventory		0	0.00%
Short-term investments		0	0.00%
Long-term investments			
Fixed assets			
Land (valued at cost)		0	0.00%
Buildings			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Improvements			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Equipment		21,200	7.00%
1. Cost	53,000		
2. Less acc. depr.	31,800		
Furniture		12,600	4.16%
1. Cost	18,000		
2. Less acc. depr.	5,400		
Autos/Vehicles		0	
1. Cost			
2. Less acc. depr.		0	
TOTAL ASSETS		**302,650**	**100.00%**

LIABILITIES		% of assets
Current liabilities		
Accounts payable	0	
Notes payable	0	
Interest payable	0	
Pre-paid deposits	0	
Taxes payable		
Accrued federal income tax	0	
Accrued state income tax	0	
Accrued payroll tax	0	
Accrued sales tax	0	
Payroll accrual	0	
Long-Term Liabilities		
Notes payable to investors	135,000	
Notes payable to others	0	
TOTAL LIABILITIES		
NET WORTH (EQUITY)		
Corporation		
1. Capital Stock		
2. Surplus paid in		
3. Retained Earnings	167,650	
TOTAL NET WORTH	167,650	

Figure 7: 2010 Balance Sheet

Figure 7 indicates a straight-line depreciation was used to determine values for both equipment and furniture. This technique was discussed in ACCT 640, Accounting Concepts and Principles. The equipment is assumed to have a five year life with no salvage value. The furniture is assumed to have a 10 year life with no salvage value.

Breakeven Analysis: The type of analysis was chosen to determine the breakeven point at which the company's expenses match the company's receipts from fees. This is the point in which the business has neither made a profit nor incurred a loss. This is an important reference point for Summit A&E. As Figure 8 shows, the point at which Summit A&E is profitable is 60 percent billable hours. Based on current expenses, Summit A&E must achieve an average of 60 percent billable hours over a specified time period in order to be successful. The company must constantly monitor this number in the event of increases in expenses.

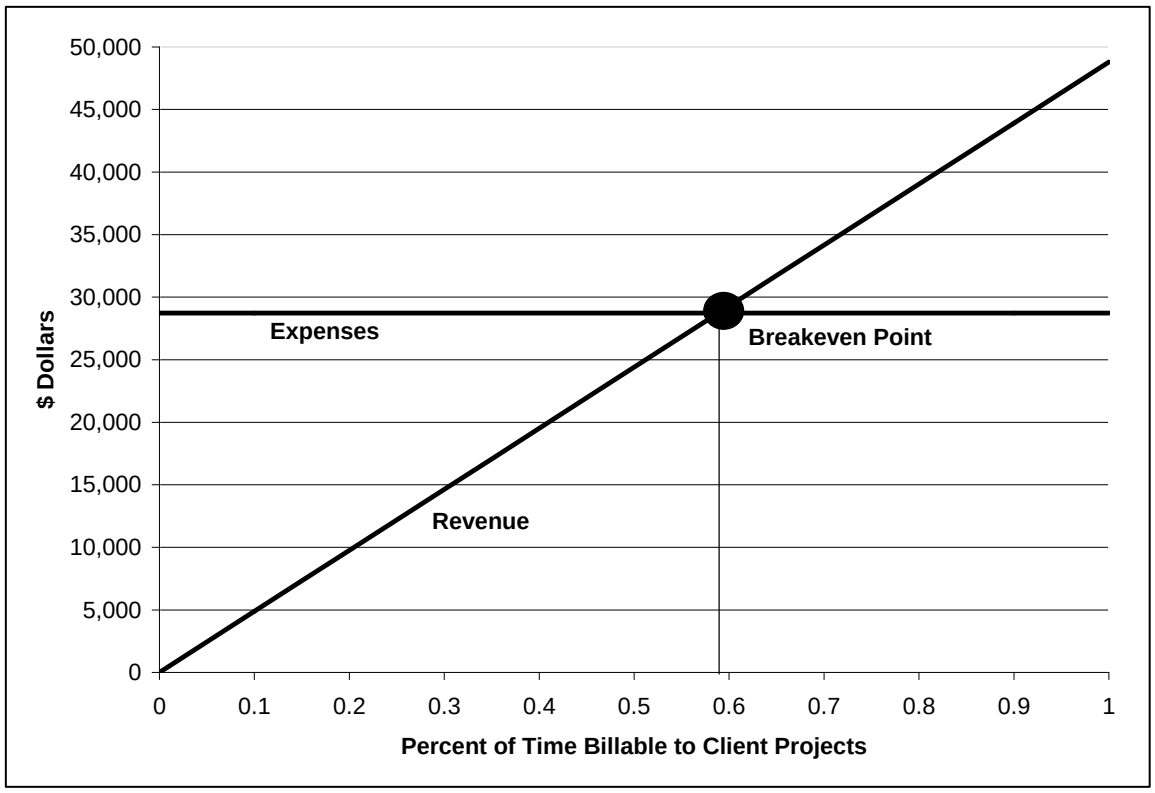

Figure 8: Breakeven Analysis

- Supporting Documents

The final part of the business plan contains the supporting documents. Summit A&E's supporting documents include the resumes of the two Principals. These resumes can be the deciding factor in whether a loan can be obtained for the business. Lenders look for experience and education in the related field of business. The two Principals in Summit A&E have extensive experience in engineering, architectural design, and project management.

PLC EMPLOYEE INTERVIEWS

The next step in developing Summit A&E was to interview the people at PLC and their respective clients. A small company with a limited number of employees provided realistic data in the preparation of the business plan. According to information gained from interviews with Mr. Biggs, PLC has proven itself to be a stable and profitable company enjoying an excellent reputation in the community. Because of the author's limited experience with private companies, an essential step in creating a successful business is to work and learn the basics from actual employees. The internship position presented the perfect opportunity to interview the entire company. Each of the interviews was tailored to the specific position of the individual. The interview questions and answers can be found in Appendix B. In addition, a few questions were added to aid in completing the third objective; to provide a management review of PLC. In the end, the interviews provided valuable insight to all three of the objectives. The specific results of the interviews are discussed in each of the respective chapters.

A portion of the interviews served as background material in preparing the business plan. In reference to the employees at PLC, the results of the interviews are presented by expanding on the expected results and actual results broken into several key areas; hiring of staff, training and qualifications, keeping trained employees, and equipment needs of an engineering company. Because of the nature of the responses, the interviews of PLC clients are presented by only discussing the major highlights that would affect the business plan.

To ensure maximum participation, care was taken in the wording of the actual questions. The employees needed assurance that the information would be confidential and only used in the creation of the record of study. Because a number of the questions dealt with sensitive issues, Mr. Biggs and Mr. Luna were provided with a copy of the questions for their review. It was made clear that the information gathered and any conclusions reached would only be given in the final management review and ROS. The interviews were conducted over lunch in a neutral setting. The results are as follows.

- Hiring of Staff

Expected Results: Early in the internship, the difficultly in finding and keeping qualified staff to work in a mountain community became evident. One of the main drivers behind this problem deals with the overall cost of living. In a resort town such as Vail, the property values are so high that full time residents must often live quite a distance from their jobs, share costs with a

number of roommates, or accept substandard living conditions. However, there are certain mitigating factors that help bring in and keep quality individuals. The interview questions were also tailored to discover the unique job factors potential employees were looking to meet in a mountain community. The following questions were asked:

- How satisfied were you with your interview process? (on a scale of 1-5)
- Did you have any concerns when you were hired? If yes, what were your top two concerns?
- Did you negotiate any part? If yes, what were your top two concerns?
- How many other jobs did you apply for?
- Did you discuss your long term goals? If yes, what were your top two goals?

As stated, the main goal of this round of questions was to determine what specific items would be important in securing good employees. It is important to note that the first question was to determine if they had a good interview experience. It was important to know if someone had a bad experience. If they did, their responses would be examined to ensure that no negative bias was present in their responses to related questions.

The typical answers for anyone starting a new job were expected. Do I have what it takes to get the job done? Will they pay me enough to be able to live in the area? I would like to get my PE license as quickly as possible. I would like the opportunity to advance in the company. How far can I go?

Actual Results: It was not surprising to learn that everyone had a good job interview experience. The top concerns and goals were also not surprising. Coming into the company with a PE license, five years' experience with Colorado's Department of Transportation and a family to support, Mr. Grant Anderson's main concern was how much work PLC could sustain. His goals included gaining experience as a project manager. On the other hand, being new graduates, Mr. Romeo Baylosis and Ms. Nina Landis were only concerned with getting hired. Their goals included obtaining their PE licenses and learning the basics of civil engineering site design. Ms. Nunley's main concern on being hired was having the right kind of background to be effective in her job. Her main issues were health insurance and vacation time. Ms. Nunley's principal goal when hired was to ensure security and stability in her job.

- Qualifications and Training

Expected Results: It is important that an engineering firm hires individuals with as much experience as possible in their respective fields. But, what if you do not have a very large candidate field? Is there a minimum requirement? Can you hire someone and train them for the job? What kind of training would be needed for this type of work? These questions needed answering before beginning the business plan. The following questions were chosen to determine the answers:

- If you were hiring your replacement, what skills, qualifications would you be looking for?
- How long did it take you to get up to speed?
- Do you feel that you have adequate training to get the job done?
- Is there any training you wished you had?
- How about continuing professional education? How do you meet the PE requirements?

The expectations regarding this subject changed a great deal throughout the internship. During the first few months, the AutoCAD skills necessary to accomplish even the basic of tasks were overwhelming for the author. Over time, the repetitive nature of this type of civil engineering became apparent. With this in mind, the engineer's answers during the interviews were expected to demonstrate a pattern consistent with frustration in learning a new AutoCAD problem followed by a sense of relief that the majority of commands and techniques used in a project were similar. As far as professional education, training classes sponsored by the company were expected to provide an immediate and noticeable benefit. As such, it was doubtful that the engineers would be looking at training outside the realm of site development.

Actual Results: In the case of engineers, the consensus of the interviews led to the ideal candidate being an engineer with a PE license, at least 3 years experience practicing civil engineering, proficiency in AutoCAD, and some project management experience. It was refreshing to see that all three engineers stated that they had gained enough experience and knowledge to work on a project unsupervised after only one year. As expected, the engineers sought training related directly to their jobs. They expressed the desire to learn more about AutoCAD Civil 3D, drainage design, and new trench less technologies. The important

qualifications of an effective office manager included experience in book keeping, knowledge of a financial software program, knowledge of human resource functions, and a outgoing personality. It was not surprising to learn that training in database management was first on the office manager's list.

Although there were differences based on jobs, there was one common qualification stated by everyone at the company. This qualification was the need for any employee to "fit" into the company. Their definition of "fit" implied that a new employee must have an outgoing personality and share similar interests in extracurricular activities such as skiing and hiking. Even though a small mountain company has to compete for limited resources, it would be a mistake for a company to settle for an employee who did not fit well into the company. You can not train someone to fit into an established environment. It is worth the time and effort to ensure the right employee is hired.

- Keeping Trained Employees

Expected Results: Once you have trained your employees, it is important that you keep them. Unlike large organizations, small engineering companies cannot afford to continue to train new employees. As the interaction between the clients and engineers grows, the company's reputation becomes based on the specific individuals. Losing an employee to another firm in the same area would most likely result in losing the client as well. If this pattern continues, it is likely that the company will not survive. Because of this, the management at PLC was expected to ensure it understood everyone's long-term goals to anticipate changes in employment requirements. For example, if an employee's long-term goal was to run a similar company and the company's owners were not planning on retiring within the near future, that employee might only stay long enough to learn what it takes to start another company. In addition, money was expected to play a large factor in enticing people to stay. To obtain some insight on these and other unknown issues, the following questions were asked:

- What are your long term goals now?
- Do you feel adequately compensated for your efforts? If no, besides money, what would you want in return?
- If you were thinking of leaving in the future, what would it take to get you to stay?

Actual Results: Some interesting results were discovered on this subject. All of the engineers' long-term goals included the option of leaving the company for better opportunities. However, all the engineers were satisfied with their current compensation packages. They remarked that the company provides them with a number of intangible benefits to include flexibility in the work schedule to take advantage of leisure activities such as powder days and ski passes. Besides a dramatic increase in pay, it appeared that these benefits keep them satisfied with their jobs. Ms. Nunley held similar opinions. Replicating these results in a new business would not be hard. However, the implications of ignoring these results might create some serious problems with employees leaving a company early to find another company willing to accommodate their extracurricular needs. One must plan on employees reaching a point in which they will leave. The goal would be to delay this departure for as long as possible.

- Equipment Needs

Expected Results: The generic requirements of starting an office for a small engineering and architectural firm are not difficult to determine. Although the web is also a good place to research the specific requirements, it was important to determine how PLC met its needs. The best person for answering this question is Mr. John Fee, PLC's system's manager. He was asked the following questions:

- What software systems are critical for running the office?
- What hardware systems are critical for running the office?
- What type of information management system would be most useful for data management?

Actual Results: Because the author had been using the specific hardware and software, Mr. Fee's responses to the type of equipment were not surprising. However, the cost of the equipment was surprising. It seems that AutoCAD now commands a premium for the use of its software. The good news is that the hardware has come down in price in such a magnitude that it more than offsets the increase in the price of the software. Mr. Fee also stressed the importance of an effective file management system. He added that there are a number of good choices on the market. This information was extremely helpful in determining the initial and operation costs for running a similar company.

In summary, the interviews at PLC provided valuable information. Because of the format of the business plan, it would be hard to include all of the actual results into the business plan. However, all the information is important for the successful operation of a small mountain business. As stated, this type of information was gathered from individuals who have already learned the essential requirements of the business thus preventing common mistakes. A number of the things learned in the interviews but did not make it directly into the business plan included:

- Ensure the business plan takes into account offering the best benefit package possible to attract the highest quality of people in the area
- Take into account the time necessary to adequately train new employees
- Ensure the right training is available from the beginning
- Ensure the right hardware and software are available
- A qualified office manager is key to the success of the business
- Intangible benefits are critical to retaining trained employees

PLC CLIENT INTERVIEWS

Two of PLC's clients were chosen for interviews. The first was Mr. Chad Sallie, a project manager for the Town of Vail (TOV). Not only does PLC receive a great number of projects from the TOV, they also must work with them to obtain approvals on all projects within the town limits. The second client was Mrs. Kathy Helmers, the office manager for the architectural firm of Fritzlen & Pierce. Outside public works, the majority of PLC's clients are architectural firms. These firms serve as the general contractor with PLC acting as one of many subcontractors. The full text of the interviews can be found in Appendix B. As with many of the results from the employee interviews, the results of the client interviews did not make it directly into the business plan. However, the results can be used to obtain an advantage to secure clients in a competitive environment. The following highlights the main points of the interviews:

- Town of Vail
  - Most TOV contracts are unit price
  - There is a $50,000 threshold for contracts before they go out to competitive bid

- Majority of projects are for capital street improvements, road reconstruction, drainage and grading
- Effective project management defined as keeping projects on time and on budget is a key concern for TOV
- Maintaining the schedule is the driving factor in large projects
- You do not have to be a local to be effective
- TOV uses a best value approach defined as evaluation and acceptance of bids based not solely on price, but on previous experience and qualifications

- Fritzlen and Pierce
  - 65 percent of project contracts are based on time and material
  - 35 percent of projects are based on total construction cost (Architectural fees of 5 to 6 percent for commercial projects and 9 to 10 percent for residential projects)
  - Project management is extremely important
  - 95 percent of projects require outside engineering consultant
  - Construction cost increasing 15 percent per year

BUSINESS PLAN RESULTS

The complete business plan can be found in Appendix C. In order to solicit constructive feedback on the business plan, a copy was sent to Mr. Patrick Mullane, a recent graduate of Harvard's MBA program. Based on his review of hundreds of business plans over the past eight years Mr. Mullane stated, "I had a chance to review your business plan and was impressed with how thorough it was. I think it's something potential investors and banks will receive well and should help you secure financing." Mr. Mullane did point out three areas for improvement. First, the income level of prospective customers was too low at $150,000. He felt the minimum income level should be raised to $200,000. Next, all income should be report as "family income." The final comment concerned the lack of a pro-forma balance sheet. All of these issues were addressed in the revised plan.

The final step in meeting this objective was to have the business plan reviewed by a prospective lending source. After researching the internet, the author chose Wells Fargo, the only three star rated financial institution in the country. The author contacted the local branch in Avon, Colorado and arranged an interview with one of their loan specialists, Mr. Jeff Leistad. A copy of the business plan was provided to Mr. Leistad before the interview. During the

interview, Mr. Leistad stated, “I think your business plan was great and was well researched.” Mr. Leistad made two comments on the plan. The first suggestion was to include community involvement such as town council meetings in the marketing section of the plan. The second comment concerned the competition. Mr. Leistad suggested that although the new company would offer a complete service in architectural design, engineering services and project management, competition from each individual specialty would have an affect on the new company.

Mr. Leistad went on to discuss how a loan form Wells Fargo would be secured. The first option was the type of loan. For this business, the two principal options are a conventional loan and a Small Business Administration (SBA) loan. Because the conventional loan requires at least two years of financial transactions, the SBA loan would be used to start the business. If the business proved to be successful during the first two years, the loan could be refinanced to a conventional loan to take advantage of the lower interest rates. Mr. Leistad also explained the process of applying for a SBA loan. The first requirement was to verify the new business owners provided at least 30 percent of their own equity into the company. The rest of the process was quite simple and included filing the name of the company with the state and federal government and applying for a federal employee identification number. Wells Fargo further assists its customers by completing the rest of the required documents in the application. Because the failure rate for small businesses is over 60 percent, Wells Fargo provides its customers several key financial services at no cost. These services include tax advice and planning, investment advice, and payroll assistance. Mr. Leistad concluded the interview by reiterating that he felt the business plan was great and hoped that the author would keep in touch over the next few years and contact him again when the author was ready to start the new business.

In summary, the results of the business plan were very encouraging. The plan answered many questions regarding the feasibility of being able to retire in a mountain community. The step-by-step approach highlighted the minute but necessary details of running a business. One such detail is the requirement for 30 percent down for a small business loan. Summit A&E’s principals would both need to add an additional $5,000 in equity. The plan is also flexible enough to accommodate the timing of starting the business. If circumstances were to change over the next few years, the plan can be easily modified. For instance, if Lance Weatherton was unable to leave his current job, the information provides a means to build a firm geared to only

the civil engineering needs of the community. In conclusion, this final objective of the internship has proven to be very valuable in meeting the author's future plans and goals.

CHAPTER III
LESSON PLANS FOR THE US AIR FORCE ACADEMY

INTRODUCTION

What does it take to be a professional civil engineer in the civilian world? When this question was asked to a senior class at the United States Air Force Academy, it received very little response. The fact of the matter is that the Academy is preparing its cadets for careers as officers in the Air Force. The specific graduating requirements of a civil engineer are for a cadet to complete 90 hours of "core" classes combined with an additional 39 hours of civil engineering courses. These core classes emphasize science, foreign languages and military operations. In addition, the typical civil engineering class only graduates around sixty percent of its cadets to the civil engineering career field. The rest of the cadets fill slots as pilots, navigators, or one of many different careers. Even the cadets going into the civil engineer field are not expected to have all the technical skills required for designing a road, bridge or even runway. Most of them will never be required to complete these tasks. Rather, they will be expected to fill the role as project managers or project programmers. With all these challenges, it is no wonder that a civil engineering cadet is not prepared for a civilian engineering career. But, does it matter? The answer to this question is yes. The latest trends indicate more and more of the Academy graduates are leaving the Air Force, some even before their five year commitment is over.

Beginning in 2005, the Air Force began a program to bring its manning down to the actual number authorized by Congress. The engineering community offered its newest Academy graduates the opportunity to leave the Air Force without any payback. Civil engineering officers with more time in the service were given an offer to leave the Air Force with a bonus based on the number of years served. Given these circumstances, it is important that the curriculum at the Academy be adjusted to expose the cadets to general methods and practices used in the civilian world.

While teaching at the Air Force Academy during the years 2001 to 2004, the author attempted to bring integration into the civil engineering curriculum. The goal of this integration was to explain the use of AutoCAD as a tool in solving a variety of civil engineering problems in the geotechnical, structural, and hydrology fields. This effort was often blocked by the general nature of how the Academy staffs its military and civilian faculty. The military assignments are for only three years. A first-year instructor is typically assigned to teach the basic civil engineer

core course, a class on airbase design and operation. After the first year, the instructor has the opportunity to teach in his or her own specialty. The final year presents the opportunity to course direct. Because of the constant change, continuity between each new faculty member is critical. This change also results in very little improvements to each class. Integration with other classes is often non-existent. On the civilian side, things are not much better. Even though civilian instructors typically stay past five years, they often give up the course director position to the military member for purposes of promotion. A course director position indicates leadership and more responsibility for the military personnel. All these reasons combine to create an atmosphere resistant to change.

The failed attempts at integration occurred during the author's second year at the Academy. That year the author was the course director for Civil Engineering 215, Computer Applications for Civil Engineers. This course taught students the basics of Excel, AutoCAD and Microsoft Project. AutoCAD had the potential to help students solve problems given in other courses. Faculty members were asked to provide copies of their homework problems. A number of lessons were adjusted to provide the basics necessary for completing parts of the assignments. The actions never caught on with other faculty members. Most did not recognize the importance of using a computer application to solve or even check an answer to a problem. With the completion and use of this objective to build lesson plans based on real engineering problems, this integration might just become reality.

METHODOLGY

The new lesson plans shown in Appendix D are the first part of the plan to institute integration upon returning to the Academy. These plans are built upon the experience gained while struggling through the first two projects at PLC; the design of the driveway for the Wolcott Wastewater Treatment Plant and the grading design for Vail Resort's new race timing facility. Because the lessons are based on a real design project from a civilian company, the lesson also serves to demonstrate how engineers design a solution to a civil engineering problem. One idea behind the integration is the addition of the many computer programs civilian engineers use to solve problems. The cadets are not expected to become experts on any one of these techniques. Rather, this type of exposure combined with the basics of engineering can instill confidence into the cadet's ability to survive outside the military.

The method chosen to present the material follows a technique that was used with success while teaching CE 464, Architectural Design. Difficult subjects were presented by first breaking them down into easy to manage steps using a more basic design. After ensuring that the cadets were able to master the steps necessary for the task, the usefulness of the new technique was demonstrated on a more advanced design. For example, to demonstrate the advantages of placing light sources within a structure, a simplified exercise was developed that showed step by step how to place a light fixture on a wall and adjust its intensity. After completing this exercise, the cadets were shown a more advanced example of a light incorporated with a sconce. The cadets took the technique and expanded it to meet their own designs. One cadet even went as far as creating recessed lighting, track lighting, and can lights throughout her house. Because of the success of this method, the lessons contain exercises that demonstrate a technique such as road profiles using a more simplistic design.

The first lesson is built around the project to create a new timing building for Vail Resort's race course. The main goals of the lesson are:

- Expose the cadets to the fundamentals of surveying
- Demonstrate how civil engineers build a surface based on the existing topography using AutoCAD Land desktop
- Demonstrate the techniques used to construct grading objects to determine finish grade around existing and proposed structures

The lesson material contains several pre drawn CAD files. The main file contains the final design of the race facility. Because it was created using AutoCAD, the cadets are able to use the layer manager function to see the step-by-step process used in the design. The auxiliary files for the lesson are based on two exercises to demonstrate the specific commands and techniques used in the design. A secondary goal in the exercises is the usefulness of the procedures in completing their own surfaces for the house they are required to design for the CE 464 class. The first exercise is based on a simple one acre site containing a number of predetermined elevations. The cadets are then shown how to use AutoCAD to build a surface. The second exercise requires the cadets to use grading objects to determine the final grades necessary to provide positive drainage around a footprint of a house.

The second lesson takes the design one step further. As stated previously, this lesson is based on the design of the driveway for Eagle County's new wastewater treatment plant. The main goals of this lesson are:

- Using AutoCAD, demonstrate the techniques used to create an alignment
- Build a profile based on the new alignment
- Determine the requirements for constructing culverts
- Build a final finished profile for a new driveway

This lesson also contains two exercises to demonstrate the basics behind the design techniques. The exercises are based on the continuation of the site design of the one acre lot began in the first lesson. The steps used in accomplishing the goals begin with the creation of an alignment for a driveway to the new house. After constructing a new driveway, the lesson continues by returning to the design of the wastewater treatment plant driveway. The cadets are shown how the culverts were designed to handle the flow from the associated drainage basin. In addition, the cadets are shown the techniques used to determine the required cut and fill for the site.

After completing these lessons, the cadets will have been exposed to the basic principles used by civil engineers on site development. They will know how AutoCAD can be used to build new surfaces from survey information. They will understand the procedures used by engineers to determine finished grades around structures, roads or other objects. They will be exposed to the different types of software available to determine hydraulic flows and culvert sizing. They will know how to use AutoCAD to determine cut and fill volumes. And finally, they will know how an engineer uses AutoCAD in the design of roadways. These topics are critical to understand the basics of civil engineering site development. The next question was whether the cadets would feel that this information was useful.

LESSON PLAN RESULTS

To answer the question on usefulness to the cadets, the lessons were presented in April 2007 to a senior class in CE 464 Architectural Design at the Air Force Academy. The author began the lecture by asking a couple of background questions. The following results were obtained:

- 3 out of 12 of the cadets planned to leave the Air Force after their five year commitment
- None of the cadets feel that they are ready to be a civil engineer
- None of the cadets know how a site plan is developed
- All of the cadets think that having this information will be useful

After finishing the lesson, specific topics that could be integrated across the civil engineer curriculum were discussed. The cadets were enthusiastic about the ability to see the techniques used by civilian engineers in solving actual engineering problems. An important note

in the discussion is that the importance of learning how to solve the problems by hand was stressed. The cadets agreed that it would be beneficial to be exposed to methods used in private practice. They even began to discuss the usefulness of some of the programs in checking and verifying their answers to problems in other classes. In the end, it further demonstrated the need for this type of integration.

The last question in this matter concerned the other faculty. How would they react to this new approach? The person believed to be anti-computer in the department, Dr. Ron Meade, was interviewed to determine an answer. Dr. Meade was known for his preference of using the old school approach to instruction. His specialty is geotechnical engineering and highway design. Over the past few years, he has only mentioned that AutoCAD can be used to solve several of his homework problems. He does not present any further details concerning CAD in his class. Surprisingly, Dr. Meade was not adverse to the plans for integrating his geotechnical classes with an AutoCAD class. He even indicated that he would be willing for a cadet to demonstrate a specific CAD technique used to solve a homework problem within his class. This was exactly the kind of attitude that can lead to positive changes. Given the right circumstances, the intent is to begin integration within the first year of the author's return to the AF Academy.

INTERVIEW RESULTS

As explained in Chapter II, a question was asked during the interviews related to the need for integration of civil engineering classes at the Air Force Academy. The following was asked of the engineers at PLC:

- What sort of topics related to AutoCAD and project management would you have liked to have seen while in school?

In every case, this question led to a lengthy discussion related to the type of training proposed for the Air Force Academy. The consensus of the group was that this type of integration between the basics of engineering and the use of AutoCAD to solve engineering problems would be very beneficial to any undergraduate civil engineering class. The specific responses can be found in Appendix B.

A follow-on question was asked of the engineers after the interviews were conducted. This question regarded the feasibility of using the AF Academy lesson plans as a tool to train new employees at PLC. After reviewing the basics of the lessons, all of the engineers expressed that the lessons could easily be modified to help better train a new employee.

CHAPTER IV
MANAGEMENT REVIEW OF PEAK LAND CONSULTANTS

INTRODUCTION

The final objective during the internship was to provide PLC with a review of its management practices. This task is easier said then accomplished. This is especially true when the review is coming from an outsider whose experiences are only based on the rigid structure of the United States Military. The original intent was to focus on comparing PLC against a number of models and examples used in school or on previous jobs. However, after spending more time with the company, the plan was shaped in hopes of providing realistic suggestions that PLC would actually evaluate and implement.

The primary driver for this approach was the education, attitudes and personalities of the PLC employees. None of the employees has an advanced degree in engineering or management. Most of the employees have only had a small introduction to project management in their undergraduate class work. The general attitude expressed towards the author was that an academic solution was not as good as one based on general practice. This type of approach is defined as addressing a problem using only textbook references. The personalities of the employees and especially management led to many one way discussions on how unnecessary an advanced degree in completing the level of engineering at PLC. Many examples of these interactions can be found in the Internship Journal located in Appendix A. Therefore, instead of providing just a textbook evaluation of the management practices, a common sense approach to the evaluations and recommendations using both class information and personal experience was specifically tailored for each situation.

This approach relied on the author's 14 years of experience in the Air Force to include the knowledge gained through numerous leadership courses, a Masters Degree in Engineering Management and two years of course work in the Doctor of Engineering Degree. The courses with the greatest impact to the review were COSC 627, Construction Dispute Resolution Alternatives and MGMT 630, Behavior in Organization. The techniques discussed on mediation and principles of negotiation in COSC 627 were instrumental in the development of the final format of the management review. This format first pointed out the positive aspects of each management topic before presenting recommendations for improvement. This approach kept the review from appearing to be focused entirely on the negative. MGMT 630 provided valuable

information on the psychological aspects of dealing with management in a fairly flat organization. This information led to an understanding of the driving forces in Mr. Luna's management and leadership which further shaped the management review. The final output reinforced the idea of providing positive feedback before discussions of improvements. In summary, with this type of approach, the comment, "After an entire year at PLC, you still do not understand how things work at PLC and in the private world" was hoped to be avoided. The management review's PowerPoint presentation to Mr. Biggs and Mr. Luna highlighting the key areas and recommendations can be found in Appendix E.

MANAGEMENT TOPICS

The rest of this chapter is devoted to expanding the main points of the presentation: management; communication; marketing; project management; and training and professional education.

- Management (Company Goals)

Background and Current Practices: It can be said that PLC's unwritten goal is to conduct business in a manner that still allows its employees the flexibility to enjoy working and playing in a mountain community. It cannot be said enough on how important this is to all of the employees. The only missing ingredient is a set of formal company goals addressing the short and long-term future of the company. It appears that this has not been a problem with the employees to this point. As time passes and new business opportunities arise, questions are bound to be asked on how the company will respond. Another great concern is when will Mr. Biggs retire and what will he choose to do with the company. Incorporating all of these issues and concerns into a defined set of goals will allow the employees the ability to compare their own internal goals to the company's. It is critical that PLC avoids the departure of several employees over a short period of time. It would likely take a long time to recover from that type of action.

Recommendations: The base for the recommendations for this topic came from MGMT 630. The course discussed the different methods of keeping employees motivated and satisfied with their jobs. For PLC, it would be beneficial for Mr. Biggs and Mr. Luna to sit down and discuss a one-year, five-year, and ten-year plan. From this discussion, a set of company goals can be created. The content of the goals is more important than the actual number of goals. At a

minimum the goals should provide insight to how the company plans to respond to future opportunities. Does the company want to expand? Will PLC continue to rely on referrals for new business? The goals can also include some insight on Mr. Biggs future plans. A formal set of goals will also provide future clients and employees valuable information about the company.

With the goals set, Mr. Biggs should take time to present the goals to the entire company for feedback. Any one of PLC's numerous informal events would be a good time for an open discussion. In the future, annual presentations can be given on how the company has met its goals or whether changes are being considered. The goals can be tied to the existing annual bonuses. With a mid year review, employees might be inspired to work even harder to achieve additional positive results for the company and their personal financial accounts. It can also provide a platform for annual reviews of all the employees. Discussion of company goals can easily turn into discussion of personal goals. Knowing an employee's personal goals is extremely important for maintaining stability in a small company. This can avoid situations where employees leave unexpectedly.

- Management (Time and Resource Utilization)

Background and Current Practices: During the busier periods at PLC, everyone is engaged in putting out the latest fire. It becomes difficult to have the time to look for any future problems or start any new work. Mr. Luna serves as a pressure relief valve in these situations. He helps out or even takes on new projects to free up time for the other engineers. The only problem occurs when he becomes so busy himself that necessary management functions such as client billing are not accomplished. If this pattern continues to hold for the entire year, the overall productivity of the office will suffer.

Recommendations: The most obvious answer to the problem is for Mr. Luna to hire another engineer. At this time, he is in the process of trying to hire another engineer. There are two issues that should be resolved before the new engineer is hired. The first is determining whether the level of work will support another engineer. Setting company goals might clarify whether the company is leaning towards maintaining the current level of work. The second issue deals with the difficulty in finding a qualified engineer to hire. Hiring an entry level contract employee under a one-year contract might alleviate some short-term needs and also give the company time to decide on its future needs.

In the area of effective utilization of resources, there is one glaring need involving Ms. Landis. She is the office "expert" on water and sewer services for Eagle County. Because of her excellent working relationship with the Eagle River Water and Sewer District, PLC has been sole-sourced for a number of large projects. The problem lies with Ms. Nina's future plans. She has indicated that she may leave PLC for an extended time if she passes the P.E. exam. This would leave a significant void in PLC capabilities. Mr. Luna should immediately begin to have all the engineers more involved in the District's projects.

- Management (Employee Interaction)

Background and Current Practices: Managing in a small company with a relaxed environment presents many challenges. A manager in this situation can not be expected to always separate professional and personal relationships with only a small number of employees. In most cases, Mr. Luna keeps interaction with the engineers on a professional level. Most of his after-hours interaction is with Mr. Biggs. However, he does take the time to discuss personal matters with his engineers while at the office. Keeping this type of exchange open helps ease tensions when conflicts do erupt. In addition, this type of limited personal interaction rarely interferes with completing the work. Unlike the government, private companies are always on the clock. Time does truly equate to money.

Recommendations: The base for these recommendations came primarily from COSC 627. The course emphasized conflict resolution was crucial to productivity. As stated, there is a good balance between personal and professional interactions between Mr. Luna and the engineers. The only issue that needs attention is conflict in the office. The majority of the conflicts occur over differences in opinions in solving engineering problems. Mr. Luna should ensure that any conflicts that occur be resolved as quickly as possible. Hurt feelings can have a negative impact on productivity. The individuals involved should be asked to quickly come to an amiable solution. In addition, PLC is also prone to gossip. This also is counter-productive, but hard to control. Mr. Luna should remind the employees to keep discussions focused on business. Outside the office, Mr. Luna should ensure some kind of social interaction at least once every couple of months. This would provide the opportunity to discuss personal issues affecting his employees. This interaction could help to prevent an unexpected departure of an engineer.

- Management (Employee Evaluation)

Background and Current Practices: There is not a formal policy on employee evaluations or reviews. Each engineer was hired under different circumstances. For instance, Ms. Landis was hired on as a contract employee to have a more flexible work schedule.

Recommendations: A good place to start lies in establishing a specific time period for annual reviews and evaluations. A time table takes away some anxiety a person may experience. With an established schedule, there is never a question on whether a year will go by without some kind of acknowledgement for the work accomplished. In addition, an annual review is a natural time for an employee to discuss changes in salary or benefits. From the manager's perspective, the review can provide a platform to discuss problems that have not been resolved. Overall, a positive benefit can be achieved by both the company and employee.

In addition to the annual reviews, recognition at the time of achievement can also boost morale and productivity. A "job well done" comment is all that is usually needed to acknowledge the effort an employee has taken in completing a project. An extra reward such as paid lunch or time off should be considered for especially difficult projects. This is often overlooked due to the nature of employees working on several projects at once.

- Communication

Background and Current Practices: Internally, PLC occasionally experiences a breakdown in communication between its engineering and surveying sides of the company. For example, there have been incidents in which the surveyors have used the wrong file to provide the data necessary to set the boundaries in the field. Other problems arise when additional information is added to an existing topographical map. Although this does not occur very often, it still results in loss of time and money. Throughout the year, John Fee has improved the situation through encouraging better management practices of the file system.

Communication between the engineers is mixed. No one hesitates to ask another person to help with a particular problem. Likewise, everyone is quick to offer any suggestions when asked. The problem comes when the person with the best answer is not in the office.

External communications at PLC can vary based on the client, the engineer and contractor involved in the project. A common breakdown occurs when the contractor starts construction. Because PLC is often a subcontractor of an architectural firm, the engineers are asked questions outside of their scope. Another common problem involves utility conflicts.

PLC makes it clear that they are not responsible for determining exact locations of utilities. However, PLC is the first person the contractor calls to resolve a problem outside the scope of the project or a problem with an unknown utility.

A smaller issue involves establishing new clients. Because Peak has built a business based on reputation, they enjoy close relationships with several clients. As such, Mr. Luna and the other engineers tend to interact with them on a more relaxed basis. This could lead to situations in which a prospective new client witnesses this less than professional interaction. The majority of the time, this should not create any problems. However, it only takes one or two lost business opportunities to have an effect on a small company.

Recommendations: This is another topic in which COSC 627 was critical in forming the base of the specific recommendations. The course demonstrated the need for understanding the different parties involved in a dispute. Every situation demands a different approach to secure success. For PLC, improvements in communication can be broken down into several areas; communicating between management and the engineers, communication between engineers, communication with clients, and communication between surveying and engineering.

Communication between Management and the Engineers: The back and forth discussion on the various methods to solve a problem can be beneficial. It encourages a free flow of ideas. It becomes problematic when the discussion becomes one sided. If it continues to happen, a person may start avoiding initiating discussions on future problems. As the manager, Mr. Luna needs to take the lead on this subject. Each person has to be handled differently. With a small company this should not be a problem. If a discussion of a problem starts to become heated, Mr. Luna should ensure that the individuals take the discussion to the conference room. A quiet neutral place is a good place to start. The person who initiated the conversation should be allowed to restate the problem and any solutions they see fit. After all the facts are known, the other individual should be allowed to present any counter arguments. If a consensus can not be reached, the ultimate decision should lie with Mr. Luna. The ability to completely state ones case goes a long way towards not developing any animosity when the decision is not to their liking.

Since communication at this level is so important for the overall health of the company, the Project Management Institute (PMI) class, “Project Leadership: A Practical Guide to

Communication, Influence, and Collaboration" (PL 2007) is recommended for Mr. Luna and Mr. Biggs. According to PMI's website, the description for this class is as follows:

> "This workshop helps project leaders and project team members improve their skills in the following areas; communicating within and outside the team, making decisions as a team, use of leadership styles, understanding and working with emotional intelligence and diverse thinking styles, conflict, negotiation, providing constructive feedback and running effective meetings. Attendees learn how to obtain the support of project sponsors and management and the commitment of members using influence skills and improved communications"

Communication between Engineers: With only three engineers in the office, it should be easy to ensure open communication between them. However, the nature of the work often dictates that they work independent of each other. Solutions to common problems are often not shared. Although this problem can never be fully resolved, there are several ways to help. The often used phrase, "command of the day" can become more formalized. This occurs when an engineer discovers a new way to solve a common problem. If a person is not in the office or they do not experience the problem for some time, they may not fully comprehend the benefit. A central repository for these solutions should be developed on the company's server. Another platform for this exchange is during staff meetings. Mr. Luna has used this technique in the past by explaining the benefits of a software document producing program. Formalizing a time during the meeting to discuss new inputs to the command of the day file could be very beneficial.

Communication with Clients: In a perfect world, a clear chain of command is established and followed for resolving issues. In reality, it is hard to make this work. PLC should strive to delineate the proper channels a contractor needs to follow when faced with a problem. The most obvious time for this interchange is during the kick-off meeting. With everyone present, the principal client can make the case for following the chain. After all, the client is the one who pays for the project. PLC can emphasize the need for this action by charging higher rates for having to address questionable issues. In reference to interchanges involving prospective clients and especially during conference calls, interaction should be kept on a professional level until it is determined that the audience does not include any unfamiliar faces.

Communication between Surveying and Engineering: The simplest solution to problems in this area is to invite John Fee to at least one staff meeting per month. This provides a forum to discuss past and anticipated future issues between surveying and engineering. This should help eliminate repeating the same mistakes such as using the wrong file to create a topographic map.

- Marketing

Background and Current Practices: PLC's current marketing strategy relies on the relationships built over the past several years between the company and the relatively small number of developers in the mountain area. PLC does not advertise in any of the local media outlets. Only an occasional advertisement is made through a part of a larger campaign by a former client. Due to its solid reputation, PLC has enjoyed a period of profitability and growth. Even with this success, PLC is often forced to react to the unique environment of a mountain community.

Vail and the surrounding communities' construction seasons dictate the number of projects awarded to PLC. Historically, there are lulls during the later parts of the summer and mid winter in which PLC could take on more work. An increased level of uncertainty usually accompanies these times. The question of whether PLC will secure enough work to pay its bills often arises. During the latter part of this winter, Mr. Luna highlighted this phenomenon by asking the other engineers to keep "beating the bushes" for new work. At one point, it did not appear that PLC was going to have any new jobs to meet its payroll. Three weeks later PLC had all the jobs it could handle forcing Mr. Luna to begin looking for another engineer to help carry the load. One way of overcoming this fluctuation problem is through new marketing strategies.

Recommendations: The lessons learned in MKTG 621 were beneficial in developing recommendations for this topic. The course provided a comprehensive look at the variety of alternative marketing strategies a company can employ. For PLC, one marketing strategy to ensure stability of incoming work would be for PLC to encourage more outside interaction between its employees and the community. This encouragement should include a monetary benefit not only for attending events such as town council meetings, but also a small bonus for acquiring new business. Because of the nature of a small mountain community, the majority of PLC's business comes from referrals spread by word of mouth at one of many social and community forums. These forums also provide a perfect setting to discuss and secure future job opportunities. It would be beneficial for everyone, not just Mr. Biggs and Mr. Luna, to be more visible in the community. Town council meetings and charity events are full of the people who

control the money going towards construction in the area. The engineers already have an advantage due to their past and ongoing work relationships with a number of town leaders and developers.

Another solution lies with technology. PLC needs its website up and running as quickly as possible. A majority of the engineering firms in the area are already on-line. Coupled with a solid reputation, PLC can secure more projects by highlighting past performances through a properly designed website. PLC can showcase its cutting edge technology in the fields of surveying and engineering. The website can provide quick confirmation of the skills required for meeting the needs of a future client.

- Project Management

Background and Current Practices: PLC does not have any full time project managers. No one has had any formal training in project management and the company does not use any project management software. Mr. Luna's job duties do include some facets of project management. He is responsible for preparing proposals, delegating the work to the engineers and invoicing the clients. The majority of the field project management is handled case by case by the design engineer. PLC rarely includes any project management in its proposals. The reality is that the nature of the work does not lend itself for the need of an engineer to be on site. In addition, PLC is typically just one of several subcontractors hired by an architectural firm. The architectural firm usually provides an overall project manager for the project. In regards to the contract, Mr. Luna does include some contingency to address concerns after construction starts. The majority of this is based on a time and material rate. There are cases in which the county or state requires certification that the contractor built the project per plan. Even at this level, the engineer is only on-site long enough to snap a few pictures and take a few notes.

Recommendations: Teaching the basics of project management through the use of Microsoft Project at the Air Force Academy served as the basis for this recommendation. The most basic level of project management and the software is a good place for PLC to start its introduction into the world of formal project management. Graduating to the level of project management discussed in CVEN 654, Design and Analysis of Construction Engineering will likely never be reached by a small company such as PLC. However, the fundamental principles of project management can be incorporated into even a small company's operating philosophy.

As stated, the use of formal project management is an area where small companies struggle. At what level of business does the use of project management techniques and/or project management software provide a positive benefit? It can be argued that a company can achieve benefits at any level. The driving factor is choosing the right balance to fit the circumstances. At this moment in time, PLC should immediately purchase at a minimum Microsoft Project. This software will allow the company to physically track all of its current projects. The type of tracking can be limited to major project milestones. Even at this level, PLC can easily answer the questions on when they have time to take on other projects. This has been a common question over the past month. Most of the time, the answer has been carefully worded to include, "We might be able to get to it in a couple of weeks." Mr. Luna has the greatest knowledge of everyone's schedule. However, this knowledge is only accurate to plus or minus a week. This could all change by using the Microsoft Project software. Project milestones can be established and updated every week with a minimal amount of effort.

There are a number of other benefits in using project management software. Engineers can use the software to plan out their vacation time. With a small number of engineers, it is important to be able to cover all the unexpected issues. Having everyone's schedule can give the engineer a quick picture to ensure the office is not completely overwhelmed while he or she is on vacation. This information can also be used during staff meetings to coordinate and resolve any conflicts in request for future vacation days. In addition, PLC should purchase a small overhead projector for the conference room. This set-up can be useful for staff meetings as well as client meetings. Any one of these reasons provides justification for the software. But, does the office have the time to effectively use the program?

After training either in-house or from a continuing education course, using the basics elements of the software requires only a few hours for each new project. Managing the process takes only minutes each day. It all comes down to ensuring a benefit is achieved. At the onset, PLC can include the cost of using the software in its proposals. A client can be shown the benefits of having access to an electronic schedule. PLC can make this information available though its website. This could lead to fewer calls by the client to check the status of a project. Another resource that PLC can use to ensure a benefit is achieved by using software is to take advantage of Ms. Nunley, the office manager. At his time, PLC is investigating the use of Microsoft Access based software to help in the organization of individual projects. Because this

system is still being developed, PLC should have Ms. Nunley investigate sources to determine if there is a hybrid software program that could serve both functions.

- Training and Professional Education

Background and Current Practices: PLC does not have a formal training process or a formal training budget. However, this does not mean that the employees do not receive any training. Mr. Luna encourages everyone to look for classes that might help them improve their skills. The company funds these training classes as time permits. A good example has occurred over the past few months. PLC has begun to prepare for the transition to using AutoCAD Civil 3D. Mr. Luna has planned to send everyone to training over the next few months in order to transition to the new program by early next year.

In regards to professional education, Mr. Luna has encouraged and provided helpful advice to Ms. Landis while she prepared for the P.E. exam. For Mr. Luna, Mr. Baylosis and Mr. Anderson, there is currently no requirement by the state of Colorado for continuing education credits for renewal of their PE licenses. However, all of them have managed to take a number of classes over the past few years related to their field of expertise.

Recommendations: PLC should set up a formal training budget. This budget could then be spread out to be included as a monthly overhead costs. Company goals could also be established for the number and type of training that the employees should expect over the course of the year. Another important recommendation is to ensure the training will provide a benefit to the company. Again, company goals can help in this matter. For instance, if the company plans to increase the number of clients over the next year, Mr. Luna can evaluate the training classes that are needed to increase current productivity levels. Because of the distance and expense sending individuals to the nearest classes in Denver, he might even weigh the benefits of sharing costs with another engineering firm to bring the course trainer to Vail.

INTERVIEW RESULTS

In relation to the management practices at PLC, the following questions were asked during the interviews:

- Have you ever used any formal project management software, Microsoft Project, Primavera, Suretrack, etc.? Do you feel that it would help in your current job?

- Based on past jobs, are there any project management techniques that could be beneficial to you job? If yes, please list techniques.

The results of the interviews showed that only Mr. Anderson had used formal project management software in a previous job. However, Mr. Anderson also indicated that he felt that his current position at PLC did not require the use of a formal project management software. Mr. Baylosis was the only engineer to disagree with Mr. Anderson. He felt that the use of the software would aid in the scheduling process. The beneficial techniques highlighted by the engineers included the use of standardization in contract proposal and development of critical path for more complex projects.

The results of the interviews aided in providing background information for several of the management topics covered in this chapter. The specific results of these questions can be found in Appendix B.

RESULTS OF THE MANAGEMENT REVIEW

The management review was presented using PowerPoint to Mr. Biggs and Mr. Luna in early May. The presentation was held in PLC's conference room using a laptop and a whiteboard. The presentation was kept as formal as possible. Each one of the topics in the PowerPoint presentation sparked further discussion. Most of the discussions involved explanations for a particular way that PLC conducts business. However, a number of discussions were directly related to the recommendations. It was encouraging to see that Mr. Biggs and Mr. Luna had been discussing solutions for some of the problems that were highlighted. Some of the main topics of discussion included:

- Mr. Luna and Mr. Biggs have been working on developing a long range plan
- Mr. Luna is willing to accept an entry level civil engineer with CAD skills to meet current demands
- Mr. Biggs and Mr. Luna both recognized that office conflicts need to be addressed
- A new employee must fit with the company's goals
- Mr. Biggs highlighted the problems of finding good training in the local area
- Mr. Biggs had attempted to start a new Professional Surveyor's chapter for the mountain region
- Mr. Biggs feels that three survey crews are the perfect number for a small firm
- Mr. Biggs does give small monetary bonuses for a job well done

- Mr. Biggs and Mr. Luna are working to integrate Engineering and Surveying meetings and coordination
- It is important to immediately address a client's concerns even if it means a loss in productivity
- Personal service is an effective way to secure repeat business
- Mr. Biggs does have need for the use of more effective ways to track client information

Overall, the presentation was successful. Even though the meeting went on for almost two hours, the discussion was focused on the main points of the presentation. Based on the resulting discussion, a great number of the topics were right on target. Mr. Luna expressed his gratitude in the method of the presentation. Specifically, he felt the technique of highlighting both positive and weaknesses in PLC was effective. Finally, Mr. Biggs commented that the presentation was very professional and effectively highlighted a number of PLC's weaknesses in a constructive manner. He also requested a copy of the complete Record of Study in order to further review all of the topics. In conclusion, the requirements for providing PLC with a management review that can and will be used to help improve the company was met.

CHAPTER V
INTERNSHIP OBSERVATIONS AND IMPLICATIONS

The ROS and its associated appendices cover a large volume of information and subject matter. This chapter is intended to provide answers to a number of related questions not directly addressed in the main body of the report.

PLC SUCCESS

One of the most obvious questions is, "How is PLC successful despite the numerous problems and issues presented in the ROS?" The first part of the answer deals with PLC's owner, Mr. Brent Biggs. Mr. Biggs has lived and worked in Vail for over 20 years. His professional and personal relationships in the Vail Valley have helped secure enough business over the past years to ensure the success of the business. In addition, as a registered professional land surveyor, Mr. Biggs has built a solid reputation in the field of surveying. As an owner, he has managed to keep a core group of surveyors through incentives such as a solid health care plan, a matching company 401k plan, and paying above average salaries. The employees have responded in kind by providing clients with a higher level of service not seen in many local companies. For instance, the surveyors are constantly discussing and reviewing the plans with the general contractor to ensure that nothing is overlooked that would lead to a delay in construction. Mr. Biggs also insists that clients receive immediate support if an unexpected survey issue comes up. Most firms cannot offer this type of same day service. When it comes to new jobs, contractors are not quick to forget this level of service. In summary, as the owner, Mr. Biggs has focused on building and maintaining positive relationships within the construction industry.

A minor fault that can be directed at Mr. Biggs is his unwillingness to exploit his reputation to expand the business. At his point in time, Mr. Biggs is very comfortable in the level his surveying business has obtained. In the final management review, he even pointed out that the perfect number of survey crews for a small company is three. Mr. Biggs felt that this number allowed easy management of the personnel required to address the needs of the smaller residential and commercial clients in the local area. In addition, Mr. Biggs has reached a comfortable point in his personal finances. He no longer needs to make more money to sustain his current life style. The best example of this aversion to expansion is the fact that Mr. Biggs

has chosen not to take advantage of a new private ski area development in Vail. This new area has 800 plus lots starting at a minimum of $1 million dollars per lot. PLC secured the initial survey and plat for the development because of the personal relationship the developer has with Mr. Biggs. However, Mr. Biggs has no plans to expand the business to meet the anticipated survey needs for this multi-million dollar development over the next five to ten years. This stance does not have to be seen as a fault unless the goals of the one or more of the employees include improving their own positions in a company due to company growth. This is an important area to consider when conducting employee interviews and evaluations. In summary, increased growth is an area in which every new business owner would like to face. A good business plan should address how growth and loss will be handled.

The previous discussion only explains how half of the company is successful. The success of the engineer side of PLC is rooted in the early formation of the company. Although PLC was officially formed in 1997, the company operated as Peak Land Surveying, a surveying only firm, for a number of years previous to that date. It was only when one of the original owners decided to leave the company, that the engineering side of the business was formed. Mr. Biggs realized in 1997 that additional survey business could be obtained if the civil engineering design was completed within the same company. The first several years in experimenting with this new business plan were not successful. The surveying business was supplementing the engineering business. However, the surveying side was able to receive new business from the work completed by the engineering side. The main problem in turning an engineering profit was the lack of leadership and management. Several unsuccessful attempts were made in filling the position of Vice-President of Engineering at PLC. The engineering business improved beginning in 2002. At that time, PLC hired its current staff.

Although the ROS has shown Mark Luna to have deficiencies in leadership and management, the engineer staff has overcome these obstacles in spite of Mr. Luna to become both successful and profitable. In fairness to Mr. Luna's impact to turning a profit, he did implement a policy requiring PLC designs to be completed to a higher level than typical seen with other engineering firms in the area. Grant Anderson, Romeo Baylosis, and Nina Landis ensure that this high level of detail is obtained on every design. This effort has resulted in solid and increasing profits for the engineering side of PLC. Mr. Luna also has kept the number of new engineering projects to a level that can be handled by his staff. Over the past year, he has turned down several large projects that would have strained the staff. This might have resulted

in a lower quality of design which would be counter-productive to the high quality philosophy of PLC's engineering staff.

As with the surveyors, Mr. Luna has kept the engineering staff intact using the incentives put in place by Mr. Biggs. He pays the engineers a higher salary than other local firms, offers a comprehensive health plan, and provides a matching 401K plan. He even provided Nina Landis with more time off by modifying her contract. These tangible and intangible benefits of working at PLC have overcome numerous incidents documented in the ROS and journal in which the staff has been pushed close to the point of leaving.

In summary, PLC has achieved its level of success because of two main factors. First, PLC continues to secure new business because of a higher level of service it offers combined with its close relationships within the community. Second, PLC has been able to keep a solid core of employees through the use of tangible and intangible benefits. As long as PLC maintains these factors, it should continue to remain a profitable business. However, even slight changes to this model can have devastating results. A small company like PLC does not have a cushion to mitigate any sudden changes. For instance, the sudden loss of just one engineer during the busy summer construction season could lead to delays in completing projects resulting in damage to PLC's reputation. Brent Biggs and Mark Luna need to constantly consider this and other factors presented in the ROS's management review to ensure PLC's continued success.

SUMMIT A&E SUCCESS

A second question that needs to be addressed relates to how the author can use the information gained from the internship to ensure a similar success in starting Summit A&E. The answer to this question can be broken into many parts. The first part deals with the Principals and the variety of issues faced before and after the business is started.

Before a business is opened, the Principal must first decide whether the risk associated with the new business is manageable. For Summit A&E, this decision is very important because the Principals are using their home equity to secure the business loan. Failure of the business during the first years will likely result in foreclosure and bankruptcy. Therefore, the Principals must be completely satisfied with every aspect of the business before the final paperwork is signed. For Summit A&E, this decision was made easier because of the author's year as an intern. The author was able to experience the business without any risk. In addition, the author was able to gather valuable information on how to secure new business, how to secure repeat

customers, and how to keep employees satisfied in the unique climate of a mountain community. The author used all of this information in the development of Summit A&E's business plan. However, the Principals must remember that the plan must be constantly modified to guarantee the information is as accurate and relevant as possible. This level of maintenance keeps small problems from becoming large destructive problems.

One of the areas of the business plan that must be constantly monitored is the business forecast. A good business plan will always show a level of business that ensures the profitability of the company. The forecast is often based on assumptions derived from predictions of other indicators directly related to the business of the company. This was the case for Summit A&E. Its principle indicator for growth was the Summit County Housing Needs Assessment (SCHNA 2005). This assessment indicated that population increases in the area would drive the need for an additional 500 homes priced over $500,000 by the year 2010. But, what happens if this assessment is wrong? How does the company survive? The first thing a company needs to understand is that no one can predict the future. A company must prepare its business plan based on the best information available at the time. Even if the company manages to secure a loan based on the forecast, it still must take steps to answer the original questions of how to survive if things go wrong. A company must consider all the risks and determine how to mitigate these risks. This topic was discussed at length in CVEN 689, Project Risk Assessment and Management. Summit A&E has identified the following risks and mitigation measures associated with operating its business in Summit County:

New Construction Starts Fall as Local Economy Enters Recession: There are several alternatives to mitigating this risk. These include looking for business outside the area, looking for different clients, increase the level of marketing, and reducing the number of employees. Summit A&E plans to use elements of all the alternatives to mitigate this risk. On the civil side of the business, Summit A&E plans to compete for projects in site development for local and county agencies in addition to its residential and commercial business. Completing even one local or county project a year will give Summit A&E the visibility it needs in case the company has to move more towards government projects. The Principal architect, Lance Weatherton, will also be trained in the use of AutoCAD Civil 3D in order to become billable between new architectural projects. On the architectural side of the business, Mr. Weatherton will also work at maintaining his contacts in Northwest Arkansas. There is no reason that he would not be able

to complete jobs outside the area. He has already completed several jobs in places as far away as Cozumel, Mexico. His 14 years as an architect are a valuable source of referral business. Mr. Weatherton has also had extensive experience in renovations. Summit A&E recognizes that its marketing strategy might need to be adjusted to highlight this different aspect of architectural design. These mitigation measures should help Summit A&E survive for an indefinite time. As a last resort, Summit A&E is prepared to reduce its staff to just the Principals for a period that would allow the company to retire the initial loan. At that point, the company will decide on whether to continue operating.

Competing Firms are Established Offering Similar Services: This risk presents several alternatives for mitigation. A company can immediately lower its rates to drive out the competitor or a company can add additional services in order to stand out against a competitor. Summit A&E will constantly monitor the local climate to determine how well it competes with other businesses. In the event another firm opens offering similar services, Summit A&E will step up its marketing plan to provide increased visibility within the community. In addition, the company will revisit its rates to determine if adjustments are needed.

Economy Begins a Pattern of Unpredictable Growth and Loss: This can be the most difficult risk to mitigate. Never ending changes can ruin any business plan. Companies can choose to ignore minor changes and focus on long-term indicators or companies can make immediate changes to react to any change. Summit A&E intends to make changes only after the market shows the trend to persist for a period of nine months or longer. This time period mirrors the time frame of a typical Summit A&E residential project. It also allows the company enough time to adjust its marketing strategy to secure new business based on the new climate.

New Construction Starts Rise at an Unprecedented Level: The last risk Summit A&E faces might not be considered a risk at first glance. However, many companies begin their downfall by trying to keep up with large increases in growth. There are several alternatives to mitigating this risk. These include hiring new employees, working longer hours, and subcontracting parts out to other firms. At this point, Summit A&E does not intend to hire any additional employees. However, if it becomes apparent that the increased growth will continue for a long period, Summit A&E will hire additional employees after careful analysis of how many new hires the

increased growth will support. For the current level of employees, the company will need to carefully consider how much business it can handle before the quality of work begins to suffer. The issue of overtime can help mitigate periods of excess work. However, Summit A&E intends to keep overtime hours to a minimum. Summit A&E will not subcontract any work that can be done in-house.

The last items that need to be addressed before Summit A&E is open for business follow the same topic areas discussed in PLC's management review. Summit A&E's Principals must consider how the company is going to operate and function in regards to management, communication, marketing, project management, and training and professional education.

Management: A company is managed by its owners. Summit A&E has two owners coming from two entirely different backgrounds. In order to be successful, the owners of Summit A&E had to first agree on the goals of the company. The overall goal of Summit A&E is to run a successful architectural and engineering firm in Summit County, Colorado. To achieve this success, Summit A&E intends to set a goal of retiring its initial loan as quickly as possible. Removing this burden will allow the company to focus its efforts on the business itself. The first step in this goal will be to convert the small business loan to a conventional loan at the two year point. Up to two points in interest rates savings can be used to pay down the principle. The companies profit will also be used to pay down the principle. The successful early pay off of the loan can bring the company a great deal of added benefits. One such benefit would be the ability to receive a line of credit from a lending institution. This would allow the company the flexibility to pursue larger more lucrative projects.

A second goal of Summit A&E that will lead to a successful and long lasting business is the goal of hiring and maintaining quality employees. In the first years, Summit A&E will offer intangible benefits to its employees in addition to a generous salary. These benefits include items such as flexible work hours, powder, days, and company trips. As the company begins to make a profit, tangible benefits such as retirement plans and comprehensive health plans will be offered. These are the same benefits that have proven to be successful based on the author's experience as an intern with PLC. Summit A&E intends to take it one step further by offering ownership in the company to the employees if the company continues to be successful after three years.

The style of management used will be driven by the company's goals. The management of the staff will be handled by Mr. Eric Waters. Although overall personnel decision will be made by both owners, it is important that the staff be given only one point of contact to address any concerns. Mr. Waters will work with the office manager and AutoCAD technician to refine the duties and responsibilities spelled out in the business plan. The goal will be to maximize their time by identifying any missing tools required for completion of a project. This level of interaction leads to the management topic on employee interaction. Summit A&E intends to operate as a family business. A great deal of effort will be spent in finding the office manager and AutoCAD technician. Another lessoned learned by the author during the internship at PLC is the importance of finding the right person for the job. The person must fit with the company's philosophy and goals. As with PLC, Summit A&E will hire individuals that want to live and play in the mountains. Leaving the pressures of work to go mountain biking, hiking, or kayaking can help keep a person both physically and psychology fit. This level of effort required to find the right employees is a principle reason for treating them like family. The use of first names will be encouraged when clients are not present. Summit A&E does recognize the importance of presenting a professional organization to its clients.

Communication in the company is another key area to the success of the business. Within Summit A&E, communication of issues related to projects will be required and encouraged. Time will be devoted to every morning to address the day's business and to discuss any anticipated problems. For communication issues related to personnel, Mr. Waters will devote time every six months to sit down with the employees to provide feedback on performance and to discuss personal goals and concerns. Both Principals will also provide daily feedback to recognize job performance and accomplishments. Small rewards such as gift certificates will be used.

Because the majority of business is architectural design, communication with clients will be handled primarily by Mr. Weatherton. Mr. Waters will be available to address civil engineering concerns with clients. Both Principals will be responsible for communication with the construction superintendent. All communication with clients will be kept on a professional level. This point was highlighted in the management review of PLC. As with PLC, Summit A&E can not afford to lose any clients due to perceived fault in communication. Finally, a communication log will be required for every project to help ensure dissemination of problems and concerns.

The job of managing the marketing aspect will be divided between Mr. Weatherton and the office manager. Mr. Weatherton will be responsible for determining the level and effectiveness of the overall marketing campaign. The office manager will be responsible for the logistics in implementing the marketing plan. Both Principals will work at improving Summit A&E's visibility in the area by attending town council meetings, joining local business associations, and participating in social and charity events.

Project management in Summit A&E will be handled by both Principals. Mr. Waters and Mr. Weatherton both have extensive experience in managing projects. Summit A&E will use Primavera software to manage its projects. Clients will be given direct access to the company's website to track the progress of the project. In addition, the software will help Summit A&E manage its time and resources. This will help determine the number of new projects that can be handled by the company thereby making it an excellent tool in determining when to focus on a particular marketing strategy. Because of the importance of project management to the client, the company will monitor the effectiveness of all aspects of project management to determine the best approach in saving time and money for the company and the client. After determining the optimal level of project management, the company will make any small corrections based on reviews conduct after each project is completed.

The last topic in running a successful business deals with training and professional education. The Principals at Summit A&E will evaluate the advantages of implementing any changes in the AutoCAD software used by the company. The costs associated with implementing changes are negligible. The initial purchase of the AutoCAD software includes yearly updates to the program. However, trying to keep up with every new feature of the program can lead to inefficiencies. Summit A&E will also ensure the office manager and AutoCAD technician are allowed to take training classes to improve their job skills. The company plans to include a formal training budget as soon as financially possible. Finally, the Principals will take the necessary classes required to renew their professional licenses. These classes will focus on skills necessary to improve the business.

In summary, Summit A&E's success cannot be guaranteed. However, the odds of success have been greatly improved due to the author's time spent as an intern with PLC. In addition, the time spent in developing the ROS has revealed several areas that will need to be carefully monitored and revised to meet the changing business climate. In the end, the success of the business lies entirely on the individual efforts of the employees.

CHAPTER VI
SUMMARY AND CONCLUSIONS

The specific requirements for the ROS provided the necessary guidance to complete the last requirement for the completion of the Doctor of Engineering degree in Civil Engineering from Texas A&M University. This report documents the time spent as an intern with PLC in Vail, Colorado from the period of June 2006 to May 2007. The future goal of living in a mountain community after retirement from the Air Force was the principal reasons for choosing Vail. As part of the ROS requirements, both a company profile of PLC, and a description of the principal responsibilities were provided. The majority of the ROS explains how each one of the three final objectives was accomplished. These objectives included writing a business plan to start an engineering and architectural company in a mountain community, developing new lesson plans for instruction at the US Air Force Academy and providing a management review of PLC. Each one of these objectives required drawing on solutions from past experiences. These experiences included working with government contractors, private contractors, and federal, state, and local agencies. In the end, the completion of each objective proved to be a challenging and rewarding experience.

The first objective of creating a business plan to start a firm in the mountains proved to be the most eye opening. The professional career of an Air Force officer is spent in the non-profit arena of the federal government. Although evaluations were based on performance, promotions and success never hinged on whether an individual turned a profit for the organization. Being able to work at a company in the same business and same community provided a great opportunity to learn the basics of creating and maintaining a profitable business. The internship also provided the perfect opportunity to conduct interviews of PLC's employees and clients. By interviewing PLC employees, questions were answered regarding how to find and hire employees in a limited market, the specific requirements for an employee for this type of business, and how to keep trained employees. By interviewing PLC clients, a litany of important facts in securing business in a competitive, reputation based environment was discovered. This information combined with the knowledge gained from reading several publications resulted in the creation of an effective business plan. This objective was completed by obtaining feedback and recommendations from both a recent graduate of Harvard's MBA program and a loan specialist at a local branch of Wells Fargo Bank.

The second objective of writing new lesson plans for the AF Academy was chosen for personal reasons. Based on past experiences teaching at the Academy, the need exists to provide the cadets with a more integrated and comprehensive look at the real world of civil engineering. The two principal hurdles to this need are the resistance to change the curriculum due to the nature of the rotating staff, and the limited number of civil engineering courses due to the Academy's core requirements. The lesson plans were based on the first two projects while at PLC. The technique chosen to present the material relied on using simplified exercises to explain complex parts of a complete civil project. The goals of the lessons were to introduce civil engineering students to the methods used by a practicing civil engineer to solve site design problems. The specific topics included site grading, setting alignments and road profiles, and hydraulic design. Feedback was received by presenting the lessons to a civil engineering class at the Academy. The cadets expressed a similar opinion for the need of this type of practical knowledge and integration. Enthusiastic support was also received from a number of civilian instructors at the Academy.

The last objective to provide a management review turned out to be easier than originally thought. The principal concern was the ability to provide solid recommendations that the company would actually implement based on limited experience in the civilian world. This concern was overcome by tailoring the review with a common sense approach to a number of key areas. These areas included company goals, time resource and utilization, employee interaction, employee evaluation, communication, marketing, project management, and training and professional education. Each area highlighted the background and positive aspects used by PLC before providing recommendations for improvements. This approach appeared to have been a success. Positive feedback from both the immediate supervisor, Mr. Luna and the owner of PLC, Mr. Biggs was received.

In reflecting back on the time at PLC, there were a number of personal benefits. First, it was fortunate to have experienced living and working in Vail. This first hand experience has provided a glimpse into what life would be like after retirement. It is hard to imagine a better way of spending the past year. In returning to the "real" Air Force, looking back on the experiences will keep my motivation high until the day of retirement.

Besides the profit aspects of having a non-paid engineer working for you, one of the more surprising benefits to PLC of the internship dealt directly with the completion of the lesson plans for the Academy. In listening to conversations with regards to bringing in a new engineer

to help with the work load, it became apparent that the lesson plans could actually help a new hire at PLC. During the interviews with the engineers, they were asked about the possibility of modifying the lessons to ensure the basics of site development according to PLC were covered. All of them indicated that it could be easily modified to provide the training necessary to complete a typical project.

As far as the Air Force is concerned, future benefits from the time at PLC can not be guaranteed. It will be a difficult and long process to begin the integration of the curriculum at the Air Force Academy. However, the method chosen should help overcome the many bureaucratic obstacles typical of the Air Force Academy. Even with setbacks, the education gained from this program will only improve the odds of success.

In conclusion, I have increased my knowledge of project management during the past three years. I intend to put this knowledge to good use during my future career in the Air Force and beyond. Finally, I wish to again express my gratitude to the Texas A&M faculty, the US Air Force, and Peak Land Consultants. I could not have completed this program without their support.

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APPENDIX A
INTERNSHIP JOURNAL

Internship Journal

30 AUGUST 2006:

I learned a valuable lesson unrelated to my work at Peak. ALWAYS back-up your data. My computer hard-drive crashed and I lost all of my previous entries. So, I will attempt to summarize my experiences over the past three months.

I started Peak during the first week of June. Because of the size of the company, I did not receive any formal training. I had already spent time with Peak during the previous December, so I was basically oriented to how business was conducted. The office is divided into two parts, engineering and surveying. On the engineering side, there are three engineers (Nina, Mr. Anderson and Romeo) and one supervisor (Mr. Luna). On the surveying side, there are two professional land surveyors (Mr. Biggs, the owner, and Liz), two office personnel (Jodie and John), and six surveyors (Flynn, Andy, Keith, Jim, Paul and Adon,). The office has one admin person (Ms. Nunley). Work comes into Peak. Peak does not solicit outside work. Because Peak is familiar with the details required by both the town and county, they are able to secure plenty of work through word of mouth and previous experience. In addition, Peak does a lot of work for both the town of Vail and Eagle County and maintains a good working relationship with them. Finally, being local also has many advantages compared to some larger companies operating in Denver (approx. 100 miles east of Vail). Peak understands the local community and regulations, understands the local conditions and climate and can quickly respond to problems.

Peak concentrates their services to surveying and land development (Site design, drainage and utilities). Because of the nature of their work, Peak is heavily involved with many local architectural firms. Although these relationships are often in conflict resulting in some heated “discussions”, Peak maintains good relations to ensure future recommendations for civil design. It is truly a “small” community, where everyone knows everyone.

At this point, I think it is important to give you a small profile of the people at Peak. I will begin with the engineering supervisor (also my boss), Mr. Luna. My first impression of Mr. Luna has not changed since I first met him back in August of 2005. He is very outspoken and confident. Two good traits in a leader. However, over the past few months these traits also seem to be a source of contention with his engineers. I will expand a bit later. First, the basics: He is single and 37 years old. He lives a fairly social lifestyle. He has experience working for the state in California. His job allowed him to spend time learning the many different aspects of engineering and design. He gained more experience in land development while working for the city of Frisco (25 miles from Vail). I plan to learn more of the specifics behind his experience in future interviews. I do know that he has not had any formal training in project management or engineering management. He has developed his management techniques "on the job". When he arrived at Peak, he had to learn on the job as well. Mr. Luna's official title is Vice President of engineering. His duties revolve around managing the engineering side of the business. He assigns the new jobs to the engineers, provides oversight in the design, serves as a focal point for any problems, and prepares the invoices for the services performed. He stresses the fact that he does not handle any specific "big" projects, although he does from time to time take on a few small jobs and jumps in to help when someone is on vacation. He has explained that his style revolves around letting the engineers handle most of the actual design work. Again, I will probe a little later on more details of his management philosophies.

As far as his involvement with me, I feel he is not quite sure of my capabilities. At times, I think that he feels I am putting a microscope to his management style. It is important to note that I have not once talked with him about his project management. I even acknowledged that I was quite aware that "book" learning does not always apply to actual practice. He seems to forget that I have been in project management for 13 years. This lack of awareness with my abilities was evident my latest assignment to do construction inspection on one of our jobs with CDOT. Mr. Luna spent quite a bit of unnecessary time explaining to me how to do construction inspection. I kept quiet the whole time as Mr. Luna and the project engineer worked out the details of how I should carry out the inspections.

Returning to the issues of problems in the office, I feel that a lot of the reasons to these problems are due to Mr. Luna's personality. His confident attitude is border line on the extreme of having to be always "right" regardless of the situation. For example, Mr. Luna had a confrontation with Mr. Anderson over a design requirement. Mr. Anderson was trying to

explain the need for doing the design in a particular way when Mr. Luna stated in a most "unpleasant" tone that he did not want to hear Mr. Anderson's explanation. He just wanted Mr. Anderson to do it his way. This seem to be in contradiction to his own stated goal of letting the engineer's decide on the best ways to complete the design. It seemed like such a trivial matter, but might be attributed to Mr. Luna's need to reinforce his need to feel "in-charge". This is just one incident. On numerous occasions I witnessed how Mr. Luna tries to his "two cents" into a problem. It seems like Mr. Luna is trying to show that he is an "expert" on just about anything the office does. That is another big problem. No one can be an expert at everything. I know his attitude and actions create tension because the other engineers hold nothing back when Mr. Luna is around. He has even come close to having one or more of the engineers quit. I am "delicately" working on determining the reasons that they stay. Overcoming this personality trait will be one of my biggest problems when I provide Peak with a recommendation for improvement. I will have to start working on a diplomatic way to explain to Mr. Luna the problems he is creating. This is going to be even harder since I have yet to hear him admit to a mistake. I hope to use several techniques that we discussed in my conflict resolution course.

In regards to the other engineers in the office, each one of them has their own unique personalities. Probably the most colorful of them is Nina. Nina graduated from Bucknell and is currently an EIT and at age 28 is the youngest person in the office. She is very much a classic "tree-hugger" type very much concern about the environment (Which in my opinion is not a bad thing). Having a "discussion" on the finer points of the government's policy on environmental issues often helps diffuse some of the tension that builds up in the office. She has told me that she intends to stay at Peak until she can pass her PE exams. At that point, she wants to take time to travel around the world. She then intends to return to Vail to start her own business using her numerous contacts within the town and county. As for now, she is not shy in expressing her opinions. Mr. Luna seems to take a different approach to managing her. Even when some of her wrath is directed at him, he seems to let her just "vent" her frustrations. Nina almost always apologizes after the situation has cooled. I think a lot of the reasons Mr. Luna uses a different management technique is due to her "expertise" within the office. Nina works on a great deal of water and sewer services for the town and county. Mr. Luna had been letting her handle a lot of the coordination with the town and county by herself. However, just in the past week, Mr. Luna told her that he would attend all of her future meetings with the town and county. In my opinion,

that was another example of how he is going against his stated goal of letting the engineers handle their own projects.

The most conservative engineer in the office is Mr. Anderson. He is 32 years old and is the only married engineer. He also has an 18 month old son. He graduated from the University of Colorado. Before coming to work at Peak two years ago, Mr. Anderson worked for the Colorado Department of Transportation as a design engineer. He left the job with the state mainly due to his dislike of his immediate supervisor. He has had quite a bit of experience in the design of streets and highway interchanges. I consider him the best "engineer" at Peak (which might explain the conflicts with Mr. Luna). He is very thorough in all of his work. He also has been the biggest help in getting me up to speed on using CAD in civil design.

Romeo is the last engineer in the office and rivals Nina on his unique character traits. He is 29 years old and has been at Peak the longest of all the engineers (including Mr. Luna). As with most people at Peak, he enjoys a great number of outdoor activities. What is really interesting with Romeo is his interaction or lack thereof with Mr. Luna. He rarely solicits any suggestions on problems he encounters. That seems to keep him from having any serious conflicts with Mr. Luna. What is even as surprising is Mr. Luna's attitude in return. For example, before Romeo left for vacation, Mr. Luna asked him to complete several items that would be due before he returned. Romeo left without completing all of these requirements leaving Mr. Anderson with the job of completing them. Mr. Anderson expressed his dismay at Mr. Luna's apparent "excusal" of Romeo's actions.

I will save my next journal entry to describe the other personalities on the other side of the Peak, the land surveyors…..

Returning to my specific involvement, I spent the first month getting to know the personalities of my fellow engineers and supervisor. Because I am very familiar with changing jobs, I have developed an appreciation of getting to know your environment before attempting to set my expectations. While I was observing, I was able to begin work on several small projects. It took a bit of trail and error, but I was able to learn the basic of civil design using AutoCAD. I used these new tools in creating my first road design. Actually it was just a driveway to a future waste water treatment plant in Gypsum, CO. The road itself was only a few hundred feet long. I did include a railroad crossing in the design as well as providing grading for two culverts. It was a small project, but one that allowed me to use all the basic design features of CAD. I created alignments, developed profiles, used grading objects to create new surfaces, and combined all

the elements to create a useable set of construction drawings. It was the first time I used my PE stamp since receiving my license in 2001. This all was concluded during the last week of July.

I spent the month of August working on a number of small engineering projects. I also began my "inspection" of two projects. We are required by the county to certify that the job was completed according to all specifications. The local contractor still does not involve me in any of the problems that occur on site. I am a bit disappointed, but I completely understand the contractor's point of view. He was told that Romeo would be responsible for any resolution of problems because he is the engineer of record. I also was able to spend more time learning additional CAD commands and techniques on road and water designs. I started a drainage design for a commercial building run by Vail resorts. As of the end of August, I am awaiting the go ahead for several more design projects involving the local hospital and town of Eagle.

The last item I would like to discuss is the after hours recreation within the company. As expected, most of the employees are working in the mountains to support their love of the mountains. That is they work to be able to enjoy the mountain lifestyle of biking, hiking and kayaking. There is a definite attitude in the office that reinforces the desires to live and work in the mountains. I think this is one reason a few of the employees are willing to put up with some "problems" in the office. They are limited to the amount of job opportunities. In essence, I would hypothesize that they are willing to put up with a great deal in order to stay and live in the mountains. I will try to prove this point in my interviews. On a personal note, I did play with Peak's softball team this summer. I was the only engineer playing on the team. Everyone seems to have their own sport. I also joined the local recreational hockey league, although no one else at Peak seems to be interested in hockey.

11 SEPTEMBER, 2006

I begin this entry with a discussion with an incident that occurred this morning between Mr. Biggs, the owner of Peak, and one of the clients. The client hired Peak to complete the civil design for the building of three residential bldgs in the town of Vail. In addition, he hired Peak to complete all the necessary surveying. His problem was in regards to the surveying. The client was complaining that his surveying budget was almost used up and he still had 2 of the 3 bldgs left to complete. He felt that Peak's estimate was at fault. Peak's contract agreement with the client was for time and material, not a fixed price. The estimate was based on Mr. Biggs's past experience in completing similar jobs. The problem was actually created by the client's

subcontractor for the foundation construction. Peak was called out numerous times to survey and resurvey points. This went above and beyond the original estimate. I talked to one of the surveyors who indicated the contractor was asking Peak to do many things other contractors were able to do themselves. However, the client took the approach that Peak was to blame. Mr. Biggs did a great job keeping his cool as the client went as far as to say that the surveyors were slow due to their coming to the job with hangovers. In the end, the client accepted the reality of the situation and agreed to work on a solution for resolving the additional expense in completing the job. The principal lesson learned from this incident is that as an owner, you are the one who receives all the blame when something goes wrong. Keeping your head and allowing a person to "vent" often helps diffuse the situation. In the end however, you might loose a client. But you need to ensure that you do not loose any additional clients as a result of an incident. Small towns seem have a way to spread gossip like wildfire.

Work for these past couple of weeks has revolved around doing a lot of little things for the other engineers. The Vail commercial bldg broke ground as I completed the last finishing touches to the bldgs drainage design. Mr. Luna ended up working over some of the details. Most of them were minor changes discussed between him and the Vail project manager. This brings me to another point of contention with Mr. Luna. He has kept me from going to a great deal of meetings related to jobs in the office. I was told on numerous occasions that there are just too many people from Peak going to the meeting (no room). It is tough to get to see the interactions between Peak and outside agencies when you do not get to witness it first hand. To date, I have only been to one offsite meeting. It happened early in my time at Peak. It was between Peak and the Eagle River Water and Sanitation District (ERWSD). The meeting was very productive for Peak. Nina was presenting some options for a couple of projects. The folks at ERWSD were very open for suggestions and comments. I plan to spend some time interviewing them over the next few months. They have the authority to sole source their engineering requirements. It seems they place a great deal of trust with Peak. I would like to find out the specific reasons.

The next big upcoming event is the company's rafting trip to Westwater, Utah. This is the second annual trip. The company is providing all the food and refreshments. This is one of the motivational techniques that I expect to see as reasons employees stay with Peak. Mr. Biggs and Mr. Luna routinely buy everyone breakfast and lunch with no reasons such as birthdays, etc. (Although, they also ensure those occasions are taken care of).

To date, I completed surveys for everyone at Peak. I sent them on to Mr. Biggs and Mr. Luna for their comments. I spent a great deal of time to ensure the surveys are as "neutral" as possible. I am not trying at this point to make good and bad assumptions on the working conditions of Peak such as poor management, overwork, etc. I hope to start the interview process in November after things start to slow down from the summer construction period.

As promised, I will now take the time to explain the personalities of the some of the surveyors. However, I can not give information on all of them, because I just have not had a lot of time to get to know some of them. I will begin with Mr. Biggs, the owner. Mr. Biggs is a very unique owner. I found out that he has officially only "run" Peak for a few years. He originally was in partnership with another surveyor who handled all the operational aspects of the company. This person decided to leave the company to start his own business and sold his half to Mr. Biggs. Faced with running the entire company, Mr. Biggs decided to handle only the surveying part of the business. That is how the vice-president position in charge of engineering was created. As an owner/employee, it is apparent that Mr. Biggs does not enjoy the management aspects of Peak. On the personal side, Mr. Biggs has an outgoing personality. I found out that he understands my way of life because his dad retired as a colonel in the Air Force. If I were a psychology major, I might try to delve into how that experience has affected his style of management. Since I am not in psychology, I will stick to the basics. So far, I discovered that Mr. Biggs started college, but chose to pursue his land surveying license at a technical school. He is now at the point where he can enjoy his life. He spends a great deal of time planning rafting trips. He enjoys major league sports. He has even purchased a condo in downtown Denver so that he can stay the night after a ball game. This purchase was made under the company name. He has made it clear that anyone in the company is free to use the condo. As a boss, the surveyors do spend some time complaining about his lack of presence in the office; however, they all seem to enjoy working for him. I hope to find out specific reasons during interviews.

The two office personal on the surveying side, Jodie, and John are really the glue that holds the surveying side of the business together. Although not formally trained in surveying or CAD, John has become an expert in these fields and is instrumental in the daily operations of the business. He acts as an office manager, but in reality, he does a whole lot more. He builds base maps, handles the entire computer infrastructure at Peak, schedules the surveyors, keeps track on the status of jobs and provides additional CAD support for the engineer side of Peak. He is 35

years old and married with one kid. Finding someone with his skill set is a key ingredient to starting a business in a small mountain town. Jodie has also developed into a key asset of Peak. He does a great deal of CAD work associated with surveying such as building base maps, delineating property boundaries, etc. Personally, Jodie is a "typical" mountain employee. Single and 29 years old, he works hard both on the job and in his personal life.

29 SEPTEMBER, 2006

I had another interesting couple of weeks at Peak. First, the company trip…. As expected, it was a great time. Most of the employees were able to attend. The planning went very well. Although, I feel they went over-board on the amount of alcohol they brought on the trip. They planned for 18 beers/day/person. I am not exaggerating. This was in addition to the large amount of hard liquor. They seem to take the adage of "letting loose" a little too far in my opinion. In addition, they also brought small amounts of recreational marijuana. Most everyone participated in this past time. They knew not to ask if I wanted any. Now, I learned another valuable lesson on running a company in the mountains. They were serious when they originally asked back in June if I had a drinking or drug problem. This is the common "joke" when trying to find employees in the area. It seems to be part of the lifestyle of the majority of people in the valley (Eagle County). Now, on the plus side, I have not noticed that it carries to the "work" week. There have been only a few occasions in which someone has shown up with a bad hangover. So, the lesson is that you need to find employees who are willing to work hard in spite of their off duty pastimes.

My excitement from the trip did not last long. Upon returning to work on Tuesday, I discovered that Mr. Luna was upset at me for not coming to work on Monday although I had told him on numerous occasions that I would be out of the office to take a friend to the airport. In fact, I had told him on the previous Thursday that I would be gone. We had a long conversation about ensuring I kept him up to speed on when I would be out of the office. In part the discussion was due to my helping out with the surveyors during the previous week. He called me in to "finish" up a drawing set in order to meet a Friday deadline. Although I had plenty of time to finish the drawing, he was worried that I would be able to complete the requirements. I was under the impression that I was tasked out to the surveyors to help fill a need for that week. So, a bit of miscommunication was the root cause. So, returning to the latest incident, even the other engineers told him that I had said I was going to be out of the office. In fact, that is how I

found out that he was upset. It seems he decided to vent his frustration only to the engineers on Monday. When I came to work, he proceeded to give me the "silent" treatment. Very interesting for a manager. It again, reinforced some of my conclusions regarding his management techniques. I attempted to resolve the situation by setting up a system in outlook to send a note reminding him that I was going to be gone in the immediate future. It seems that this has cured the problem. It has taken a week, but he seems to have returned to a normal interaction with me. I also helped the situation by involving him in discussions around how the town and county handle project management. I am trying to refocus his attention to exactly why I am at Peak in the first place. It is amazing to me how quickly I become just the "intern".

All of these issues I have had with Mr. Luna have led me to document them in greater detail in my journal. I would like nothing better to just cover my observations on how the company is managed and operated. However, because of the size, I came to realize that the most important element in an effective company is the interaction between the management and employees. To date, the interaction that I have had with Mr. Luna has been at best a mixed bag. It also appears that my experience is similar to the other engineers. Again, I feel I will be able to understand the interactions after I'm finished with my interviews.

At this point, I decided to plan a trip back to A&M to discuss my internship and my upcoming finalization of my objectives. I still have confidence that I can gather enough information to fill three main objectives; 1) Build a business plan for starting/running a similar size company in a mountain community, 2) Build lesson plans based on my new CAD skills that would help benefit my instruction upon returning to the Air Force Academy, and 3) Provide a assessment of the strengths and weakness in the realm of Project Management at Peak.

In regards to my work, I picked up a project to prepare a hydraulic study for the building of a recreational path along 2200 feet of frontage road in Vail. The project is typical of the type of work Peak does and has given me the opportunity to learn how to use HydroCAD. I would like to become more proficient with this program in order to use it to build lesson plans for the Air Force Academy. It is a very useful tool in completing hydraulic designs. I also continued my inspections of the construction site in Edwards. I managed to provide a little more input into the process. The contractor still falls back to Romeo for the final call, but at least I felt a little more than just a pair of eyes to document the progress of work.

3 NOVEMBER, 2006

The month of October has been busy both at work and home. I took the opportunity to visit my sister and her family during the second week. Overall, the work at the office has started to slow down. The reasons can be contributed to the construction season in the valley. As the winter sets in, construction work picks up in pace in order to complete foundation work before the ground freezes. New projects seem to be put on hold during this period. Mr. Luna spent the better part of the morning complaining about the lack of new projects. Again, he made no indication that he would change his tactics in securing work. He did ask all the engineers to "beat the bushes" to determine when a number of new projects would begin. Specifically, he asked Nina to hound the County on several new water project designs.

I finished most of the preliminary hydraulic design of the North Frontage road Recreational Path. To keep busy, I begun to help out the surveyors in the plat for the Ginn Inc. development of a 6000 acre private ski resort on the backside of Vail mountain. Mr. Biggs, the owner, was approached by Ginn to complete all the required survey work for the development. The plat had to be submitted by 1 Nov to secure incorporation by the town of Minturn. Basically, Ginn wants to develop 480 one to two acre parcels priced at a minimum of $1M dollars. Without incorporation by the town of Minturn, Ginn can only offer 35 acre parcels. This would not provide the revenue to develop the entire property to the level planned. Minturn benefits by this arrangement to the tune of several million dollars in tax revenues. On the downside, Minturn would have to upgrade its public services to accommodate the new development. Our survey department has been extremely busy meeting this requirement in addition to the normal work load. Several surveyors have been working many 60 hour work weeks. This would be a great opportunity to bring in work to the engineering side of the company, but Ginn has already hired a Denver firm to work on the civil design. Although, I overheard that we might pick up some work after the plat is approved by the town.

The work that I am actually performing has to do with the creation of the 480 parcels within the development. I am creating, labeling and editing the parcel with the help of John. In reality, I was tasked to make the drawing "look good". It has helped fine tune several of my basic CAD skills. I learned a great deal of how surveyors create and define parcels. As this is just the first submittal, I am sure to have more practice. I also spent an afternoon create a topo drawing for the Wolcott Fire Department. This drawing required me to build the boundaries and

breaklines based on the surveyed points. Although fairly simple, this step is very important in building my lesson plans for the Academy.

I spent the last week of October in College Station briefing my advisory committee on my final objectives. I received positive feedback on my proposed objectives. The only specific comments dealt with ensuring I provide objective recommendations to Peak regardless of the limitations of the company. I hope to begin my interview process over the next two weeks. I am planning to start with Mr. Luna in order to work out any bugs or issues with some of the questions.

The only significant development in personnel came in the fashion of an interview for another land surveyor. A friend of Mr. Biggs was laid off last month from a Denver firm. Although he is a land surveyor, he spent the last 10 years serving as an office engineering supervisor, basically the same job Mr. Luna is doing. Mr. Biggs does not intend to hire him to replace Mr. Luna, but offered to take him on him on as a surveyor helping out with the Ginn development. I was able to learn a bit more about the company during his interview process. Mr. Biggs again spelled out the philosophy behind Peak, “Work hard and Play Hard”. He also walked through the formation of the company. I was not aware of the problems Peak had in Mr. Luna’s position. Basically, Mr. Luna is the third person hired for the job. The two previous people in the job did not leave a very favorable impression of Peak with the community. Mr. Luna has been able to solidify Peak’s new reputation as a quality engineering consulting firm. Mr. Biggs gave several examples of how Peak at first lost several jobs to lower priced firms, but was hired in the end to correct the poor designs. Mr. Biggs also talked about how the County got in trouble in its seemingly sole source contracts with Peak. Apparently, they were forced to use several other “cheaper” firms. In the end, it was proven to me most cost efficient to use Peak. This was due to the number of unforeseen problems not included in the competition’s original bids. Mr. Biggs also highlighted Nina’s extensive knowledge and working relationship with the town and county.

As sated, I intend to spend the next couple of weeks interviewing the employees. I added more questions to my interview to address the goals and objectives of the company and whether these items are discussed within the company.

1 DECEMBER, 2006

I would like to begin this entry by returning to the past. After rereading my journal, I discovered I left out an important story. It involves the driveway design for the Wolcott sewage treatment plant. I arrived at work one morning to overhear Mr. Luna and Mr. Anderson discussing the project. Apparently, the county engineer had a problem with the road grade break. The engineer thought that the grade break could not exceed 2 percent. Mr. Anderson and Mr. Luna were working on correcting the problem. Now, I felt a little slighted not being involved in the conversation. After some instructions, Mr. Luna told Mr. Anderson to fix it. First of all, the road profile was not my design. That part was accomplished by Mr. Anderson before I took over the project. After making some changes, Mr. Anderson thought I had messed up the culvert design. As it turns out, he only misunderstood how I had labeled the design. In addition, I was told to label the design in that manner by Mr. Luna. After overcoming the confusion, Mr. Anderson and I worked out a new road profile. As it turned out, the engineer was incorrect in his objection. The maximum grade break only applied to an actual road and not a driveway. In the end, my design was correct with one exception. I did have a small grade problem on one of the culverts. Again, I felt it necessary to include this story to build on the problems that lie with the office. As the engineer responsible for the design, I should have been the first person to discuss the issues. It still does not seem that Mr. Luna has any real confidence in my abilities or that he understands the need to resolve any issues with the specific people involved.

Returning to this month's entry, I spent the month of November continuing to help out the surveyors with various projects. I was unable to find the time to start my interviews. The first two weeks were fairly busy for the office and thus I was unable to nail down a time for the interviews. I spent the last two weeks on vacation. So, I will attempt again to begin the interviews this month.

I was able to begin work on my lesson plans for CAD. I decided to build two lessons revolving on the projects I have worked on. The first lesson is devoted to explaining how to create surfaces and grading objects. I am using the Vail Race City course building as an example. In addition, I created a small parcel that the cadets can use to build a topo for their own house design. The overall lesson is going well. I did spend a lot of time working out a format that is easy to read and follow. After many trials and errors, I arrived at a suitable format. I will get further feedback when I present the lesson at the AF academy next year. The second

lesson I planned involves building a road to the parcel I created. I will use the Wolcott driveway project to illustrate the finer points of completing the design. My overall goal is to be able to build a lesson that will help the cadets in both their AF and private careers.

This month's entry in office management deals with staff meetings. As stated previously, Mr. Luna tries to have staff meetings at least twice a month. I have sat through enough of the meetings to begin to see some pluses and minuses in the process. First, the positive. Mr. Luna prints out a current job's list to serve as the agenda. The list contains the project name, engineer, and current status. In addition, Mr. Luna includes pending projects on the list. Having the updated list gives everyone in the office a chance to see what is going on with the other engineers. Now on the down side, Mr. Luna spends the majority of the time asking each engineer to give a brief update on each of the projects. Mr. Luna used to go through the projects by engineers. The only problem with that approach was that the others tended to zone out of the conversation. Lately, Mr. Luna has been going down the list of projects. That has kept everyone a bit more focused, but still keeps most of the conversation to just Mr. Luna and the engineer in question. I would like to see the conversations include areas that would affect the rest of the engineers. Problems and solutions to Eagle County issues for example might help everyone with future jobs. On the personal side of things, I have just become an observer for these meetings. As I am not working on any specific jobs, Mr. Luna has stopped including me in the discussions. Again, as an effective leader, Mr. Luna should try to include everyone.

As one might guess, I have some major reservations on Mr. Luna's leadership. I am forced to take a step back in expressing any of my true opinions. As an outsider to the firm, I feel I am not in a position to give him real feedback… I need to finish my year with Peak to accomplish the requirements of my degree. Mr. Luna does not seem like the type of person to accept constructive criticism. Judging by the way he treats me, I am still just an intern in his eyes. I will save this feedback for my final out brief with Mr. Luna and Mr. Biggs.

As far as new jobs goes, Peak is still waiting for several opportunities to come open. The other engineers are basically finishing up some odds and ends with their current projects. NO new big jobs have opened up.

5 JANUARY, 2007

I begin the New Year with a puzzling story. Mr. Luna called me the week before while I was off between Christmas and New Years. He wanted to make sure I was coming in on the 2nd. When I got to work, he asked me to come outside so he could talk. First, that was good. He usually just confronts people in the office. However, as it was only 10 degrees outside, I ask him to go back inside to the lobby area of the building. Anyway, Mr. Luna wanted to "discuss" my activities. He was upset that I was not on the same page in regards to some as-builts I had begun to work during December. Again, a breakdown in communication resulted in his being upset. These as-builts have been sitting around in the office for over a year. I was just trying to get a handle on the requirements just before I left for my Christmas break. Nina, John and I had met with the District in early December to work out the format of the as-builts. I left for break with the understanding that I would be finishing the drawings during early January. No one had given me any deadline for completing them. As I was trying to finish up my lesson plans for teaching in the spring, I only work on the as-builts when time permitted. I still had not been given anything else by Mr. Luna to work on. On numerous occasions I asked Mr. Luna for things to do. Early in the month, I showed Mr. Luna the lesson plans I was working on and told him of my intentions to complete them while waiting on any new projects. Now, John did ask me to complete some as-builts for the survey division that he needed right away, but he was still waiting on the information. I told him to call me if the info came in while I was gone. He did not call. It seems that he asked Mr. Luna while I was gone about the status of the as-builts. Mr. Luna, not knowing how far along I was on the as-builts took it the wrong way. He apparently thought I was not giving my full attention to the as-builts. It is important to note that John and Nina were not on the same page either. Several items needed to be surveyed and John was upset when I ask him to have the surveyors shoot the items before I could complete the drawings. I told him he needed to talk with Nina to solve the problems. I was just the messenger. This was an additional item that caused me to put off working on the as-builts. So, Mr. Luna was upset. He wanted to understand my "commitment" to Peak. I reiterated the problems I had with getting the information to work on the as-builts and also reiterated the numerous times I have asked for new projects. After some discussion, Mr. Luna admitted that he has had some problems with me since the incident in October when I was out helping the surveyors. He felt I did not understand the urgency of getting a project done. I wrote about this issue previously. In summary, I was helping the surveyors when Mr. Luna asked why I was not working on a project to meet a

deadline. As I told him then, I knew how long it would take me to complete the project (it was just a couple of hours to clean up some red lines) and I had plenty of time. He treated me then like he treated me now, basically as an "intern". I hate to use this word again, but it really describes his feelings on my capabilities. He went on to say that he has hesitated in giving me any further big projects because of this. He did recognize that he should have brought this to my attention way back then. I did apologize for not recognizing that this miscommunication had occurred. He did state that he felt I did not intentionally blow off the project. He still does not get it. An effective manager does not behave in this manner. One positive note came out of this discussion. Mr. Luna did admit he has had trouble on the managerial role. He said this was his first time managing people and he has found it difficult. He also apologized for his original tone. It seems he had some personal problems over the weekend and took them out on me. He also promised to make sure to involve me more as new projects come in.

One more thing before I move on. Mr. Luna also included a statement that really has upset me. He mentioned that I had offended several people in the office by pointing out the errors in the way things are done. Now, I know this is false. I tried on every occasion to keep my mouth shut in terms of what goes on. Again, because I have been treated like an outsider, I have kept my opinions to myself. When I do ask questions on how things are done and why, I have gone on record to say my questions are just to find out the facts. I have never said, "you should really do it that way…" Specifically, he mentioned I had offended John. I questioned John after talking to Mr. Luna to find out the facts.. I know I have been short with John on several occasions when I was helping out the surveying on the Ginn project. Mainly, I was upset when he kept asking me if I checked my work. This was even after I not only checked my work, but I found several errors in things I was not ask to do. John said that he felt he did not feel I was "questioning" how he did things. I did tell him that I thought he treated me like an "intern" on several occasions. He stated that he treats everyone that way. I told him that I do not mind questions, but I also do not like to be treated like a new college graduate of 22 years of age. We finished the conversation with his acknowledgement of my attempts to just get the work done without adding any suggestions for improvement. So, it goes back to Mr. Luna and his character. He might have misunderstood John, but he still feels some resentment for me concerning my role in completing the requirements of my internship.. Again, I had to fight very hard not to begin the points of his failure in leadership.. He did take the first step by admitting he has problems managing people. That gives me hope that he might actually listen to my

suggestions when I am finished with the program. But, it also reinforces my decision to keep my opinions to myself for the time being. I still need to finish out the year and I would like to keep busy learning new skills in civil engineering.

With the holidays in December, I still was unable to start my interviews. This turned out to be a good thing. With the problems Mr. Luna was keeping inside, I do not think I would have gotten very far in understanding his management style. Hopefully, this new breakthrough will prove to be beneficial in getting some good data.

I did get further on my lesson plans. I finished up the first lesson. It is now ready to be sent out to the academy in order to set up a day to present the material. I will need to build a survey for the cadets to solicit feedback on the lesson plan. I will accomplish this over the next two weeks.

Oh, and I finished the as-builts today. As I figured, it did not take long after I had worked out the process and got John and Nina on board.

It really has been a challenge to work at Peak. After spending all my time in the Air Force, I developed my own opinion on what it takes to be a good leader. When I am faced with a bad leader, I usually do not hesitate to try to institute changes for improvements. With the military, those bad leaders are easily recognized by other members of the organization. As a group, we work to overcome the problems. This has proven to be helpful in several situations.. Except in this case, I am on my own. Although I heard other engineers complain to no end on the problems Mr. Luna causes, no one is willing to take a stand for improving the situation, I can not blame them. Unlike the military, a civilian does not have a guaranteed job. I finish this entry with a promise to myself. I will continue to hold my opinion to myself to ensure a favorable work environment. However, I am more motivated to continue to build a strong recommendation on improvements in management regardless of hurting someone's feelings.

6 FEBRUARY, 2007

Things have improved a great deal over the month of January. I have been able to work on two new projects. The first one involves the reconstruction of a condo complex in Eagle-Vail. I was able to complete the demolition plan and utility plans. The work involved a great deal of line work in CAD. I was working with Mr. Luna on this project. For the most part, Mr. Luna was able to keep things on a professional level. In one case, Mr. Luna lost several hours worth of design due to an AutoCAD error. I thought he was going to put the blame on what I

had accomplished, but in the end he worked out the issue. I was even able to help out with the situation. One thing I did see in the process concerned the issue of taking the initiative. I was trying to correct a simple visual error in the alignment of a new waterline. Even though Mr. Luna gave a good reason to not make the change, he still did not acknowledge the effort to correct an obvious flaw in the layout. Simple things like that go a long way in boosting a person's morale. It also got me thinking. Mr. Luna hardly ever tells anyone in the office that they have done a "good" job. A little positive reinforcement goes a long way.

The second project that I worked on involved the design of a new emergency stair for a building undergoing a renovation. Because Mr. Luna was busy finishing up another project, He left me alone for the most part while I worked on the design. It was not a hard process. It just took a little bit of manipulation to get the stairs to work out. The biggest problem I had was in determining the existing elevation of a sidewalk that the stairs had to tie into. The surveyors had not shot any points near the area. Before I made the final design, I asked John to have the points shot. Mr. Luna did try to argue that it did not need to be that precise. But, in the end he did acknowledge that the finished design was better because of the known elevations. A second part of the project involved another set of stairs. I was having a hard time trying to understand what Mr. Luna wanted to do. In the end, I went out to the site to get a better perspective of the area. It helped out a great deal. Again, Mr. Luna questioned the need for me to go out to the site.

After finishing the two projects, I started work on developing a model for PLC's planned website. In a very short time, I put together a working model using PowerPoint. I was pleased with the outcome of the model. I put it on the server and asked Mr. Luna and Ms. Nunley to give me their inputs. That was over two weeks ago. I even asked Mr. Luna again last week. I know he has been busy, but it would only take a few minutes to review and provide inputs. This is another error in effective management. He had asked me to get something done as soon as possible, but yet will not take the time to acknowledge the effort. It may seem that I am over reacting to the situation. However, as part of my internship, I am analyzing the management within PLC. An effective project manager should spend more time ensuring that his people are getting all the input they need to better the project.

As I indicated, work at PLC has picked up. During the last staff meeting, Mr. Luna indicated that Peak had several new jobs coming. Eagle County was able to secure a new bond issue to build a new high school and elementary school. Peak has been asked to do the surveying and civil design for the projects. This new work has Mr. Luna concerned about his

manpower. He has asked Ms. Nunley to place an advertisement in the local paper. So far, he has only had one person answer the ad. He was only qualified in CAD work. Mr. Luna needs an experienced civil engineer. This process has further demonstrated the difficulties in finding good people to work in mountain communities.

On the issue of interviews, I finally was able to interview one of the town engineers, Chad Sallie. It was a great interview. I am attaching all of the interviews in the final Record of Study. In summary, I was able to learn a great deal about how the Town of Vail operates its engineering/maintenance departments. In a way, it is a lot like how the AF runs its bases. However, the town has to overcome a number of unique constraints. One of them being the fact that Vail is dependent on its tourism. This drives all the construction schedules for both internal and contracted projects. As a project manger, Chad has to juggle several hats in order to ensure the best results. He seems to enjoy his job. I did talk to him about setting up a small engineering firm in the mountains. His personal opinion was that it would be hard to get one started unless you hired people with local experience and local connections. On a side note, Chad did ask me about working at Peak. I related to him a few frustrations in being considered an outsider who just does not understand. He had similar experiences when he started with the town. Because he has worked with Mr. Luna on projects, he did recognize the problem of Mr. Luna accepting an evaluation of Peak's project management. He basically told me, "good luck getting him to listen."

In January, I contacted the Academy to set up a date to teach AutoCAD. I expect to get a firm date by the middle of the month. At this point, I have almost completed the second lesson. Each lesson has several parts and relates to specific projects I have worked on. The only thing left to accomplish before I present the lessons is to prepare a survey for the instructors and the cadets evaluating the effectiveness of the subject matter.

4 MARCH, 2007

February has gone by quick. I finished the AutoCAD lessons in between small jobs at Peak. I am still waiting to hear back from the Academy to set up a time to present the lessons. I expect it to be sometime this month. In addition to the CAD lessons, I also began the background work in preparing to write a business plan. My initial focus is to gather information on the town and county construction numbers and forecasts.

As far as work at Peak, I kept busy with a number of small projects. One of my new jobs involves reconstruction of a road in Frisco. The reconstruction also includes the addition of a new recreation path. I was tasked to evaluate the grades on the new driveways to determine the required transition area in preparation for a construction easement for each resident. The end product of my work also helped in the preparation of an exhibit for a town meeting. At this meeting, the residents will have the opportunity to ask questions before the final design is completed. Several items of note came out of this exhibit. First, I was working with Mr. Anderson on the project. He gave me some more insight on Mr. Luna's management. Basically, he held back on a number of issues in order for Mr. Luna to put in his two cents. Most of these small issues could have been easily accomplished, but Mr. Anderson rightfully explained that Mr. Luna would change them anyway. This is a bit troubling. Employees should be willing to put forth their best effort using their own experience to accomplish a task. Having to wait for input is unproductive. This issue is going to be a main point in my review of management practices at Peak.

Another project that I am working on involves the construction of a children's spray park. The town of Vail is planning to install this spray park within an existing public park. Peak picked up the job because they completed the original design. The town's representative came to the office to discuss the initial concept. Although Mr. Luna was going to assign me the job of completing the design, I was not invited to listen in on the meeting. I received the information second hand from Mr. Luna. As it turns out, I had to redesign the layout three times because Mr. Luna was basically serving as a middle man. I could not ask any questions of the town's rep. This is yet another example of ineffectiveness at Peak. I have seen this happen with other projects. Mr. Luna needs to determine who has time to work on a new project and have them at the initial meetings. This could save a lot of confusion in the first stages of a project.

A number of problems with Peak's performance have surfaced this month. On the engineering side, the problem involved the design of a large condominium in Vail. Mr. Anderson told me that Peak failed to double check the finished floor elevation. With the check was done, Peak's new grading plan was off by four tenths. This small error caused a great deal of turmoil. I am still not sure what went wrong, but it seems to revolve on the lack on coordination between the different companies completing the project. A breakdown in communication between Peak and the Architect will likely result in a delay. This issue is hard to address without knowing all the facts. In addition, because Peak is a subcontractor, they do not

always have control in the number and timing of coordination meetings. A checklist of common sources of errors could be developed by Peak in order to formally track and communicate these critical issues. These checklists can be setup via the web for access to all parties.

On the surveying side, the problem revolved around the performance of two surveyors. Again, I do not have all the facts. However, the main concern was the lack of results from the two surveyors working on the Ginn development. This is not a good thing. Ginn can be the source of a great deal of future work for both sides of the Peak. John was noticeably upset. He vented his complaints to the entire office. This is not a good practice. Being their supervisor, John should only take his concerns to Mr. Biggs and the two surveyors. Involving the entire office in the problems only takes away from normal business. It took over week for the office talk to settle down. This is yet another example of bad communication within the office.

A rather unusual problem was effectively handled by Ms. Nunley. It seems that one of our main contractors asked one of our employees to take a drug test. As it turns out, Mr. Biggs does not write any contracts that require drug testing (with good reason). Ms. Nunley pointed this out to the company representative. I asked Ms. Nunley about this policy. As it turns out, even the town of Vail dropped this requirement for its employees. I will take this issue into account when as I write my business plan. It seems that recreational drug use is just a part of life in the mountains.

22 MARCH, 2007

Over the past couple of weeks, I kept busy with the Frisco road project. Most of my work has been on the demolition plan. I spent some time in the field to ensure the drawings were as accurate as possible. The main concern lay with the placement of the building footprints. The surveyors had only shot 20-30 feet on either side of the road. Most of the houses are set back further. The town of Frisco only has a map of the buildings drawn from an aerial survey. During my field visit, I discovered that the town's information was not very accurate. After expressing my concerns to Mr. Luna, he indicated that for this job, the building footprints were not that important. I tend to agree with him on this issue. I just hope that the town will too.

I did get a firm date for my presentation at the AF Academy. I will be going down on 6 April to give the first of the AutoCAD lessons to the CE 464, Architectural Design class. The instructor for the class also asked me to share my experiences working for a civilian company. I have a feeling that this will lead into an interesting discussion.

The other engineers have become quite busy over the last couple of weeks. As spring approaches, the contractors in the area are starting to gear up for the construction season. The office is so busy, Mr. Luna has said on numerous occasions that Peak will not be able to handle any more work for the time being. He also says that the new engineer is supposed to be here within a couple of weeks. I am eager to see how the new engineer is integrated into the company. This should give me a good idea if my experience is unique due to my short term employment.

I did spend a couple of days in the field helping out with a floodplain survey. The project is for an individual who wants to build a camp for cancer patients along the Colorado River. It was interesting to see how 100 yr flood plains are established. The specifics of the survey involved taking depth measurements of the river and spot elevations to determine cross sections along the area in question. All of the data will then be entered into a computer modeling program that takes the 100 yr storm to determine the flood plain area.

The last entry is in regards to the website. Mr. Luna finally looked over my proposal. He did comment that he liked the design. However, he did not indicate the desire to pursue the actual development and implementation of the site. With the level of work in the office, I feel that he does not feel that this is worth the additional effort at this time.

28 APRIL, 2007

This will be my last entry. The last month of my internship will be spent wrapping up any remaining details of my past projects, presenting my management review to Mr. Biggs and Mr. Luna, and continuing the writing of my Record of Study. During the middle of May, I plan to spend a week on a much deserved vacation to Mexico. Finally, I am planning a trip back to College Station to discuss my ROS with the Thesis Office. I hope to prevent any problems with the format of my ROS.

Over the past month, I have been kept busy with the reconstruction road and pathway project in Frisco. With a few exceptions, my interaction with Mr. Luna has been positive. I have been given the job of preparing all of the necessary plans for the contract bid opening scheduled for 4 May. That requires the preparation of all the civil engineering sheets. I had no problem in getting everything accomplished for Mr. Luna's review. Everyone in the office has been extremely busy including Mr. Luna. This kept him from reviewing the drawing set until

just two days before the Town's deadline. This time crunch resulted in the first problems with Mr. Luna's management skills.

The review started out with Mr. Luna questioning my project quantity numbers. After verifying that my individual numbers were correct, Mr. Luna informed me that I had incorrectly summed up the asphalt numbers. He wanted the numbers done a certain way. Mr. Luna's method made perfect sense although he could have been a little nicer in explaining the reasons. Once again, he failed to treat me as a professional. Things got a little heated when he discovered that a section of the road had not been redesigned to improve the drainage. After accusing me of not following his directions, he called in Mr. Anderson to get an explanation on what was done in the design. Now, it is important to note that I had nothing to do with the design. As a matter of fact, I was specifically told not to touch the design of the main road. Mr. Anderson pointed this out when he explained to Mr. Luna that he did not have the time to fix that part of the design. Once again, Mr. Luna failed to apologize for his accusations, but it did not bother me as much as it used to. I think I have become accustomed to this behavior or it might be that I only have one month left in the company. Regardless, I was able to complete the necessary changes in time for the Town's review.

The last problem with Mr. Luna's management was in the completion of the erosion plan for a previous project. The Architect needed the erosion plan for the final submittal. Mr. Luna asked me to complete the plan just before he left for vacation. Now, completing the plan required less than 2 hours of my time. Mr. Luna wanted me to bill the client for 4 hours. For the obvious ethical reasons, I only billed for my time. Mr. Luna will have to adjust the time himself. Looking back over the year, I definitely experienced good and bad times at work. I still feel that I have gained a great deal from my time at Peak. Over my 14 year career, I have had many bad supervisors. I learned early not to let their management style effect my overall happiness on the job. I feel extremely lucky in getting the chance to live and work in Vail, Colorado. I know this experience will help me throughout the next 6 years in the Air Force as well as my life after retirement.

APPENDIX B
INTERVIEW RESULTS

Interview Form (Engineers)

Interviewee: ***Nina Landis*** (Hired in 2003)

1) How satisfied were you with your interview process? 1 2 3 4 (5)

Did you have any concerns when you were hired? Y / (N)

If yes, what were your top two concerns (getting the job done, required skills, etc)?

2) Did you negotiate any part? (Y) / N

If yes, what were your top two issues?

- 8 weeks vacation time
- Yearly salary review (Nina is a contract employee)

3) How many other jobs did you apply for? None 1 2 (3) 4 5+

4) Did you discuss your long term goals? (Y) / N

If yes, what were your top two goals?

1) Get PE license

2) Learn the basics of civil design (learn how the industry operates)

5) If you were hiring for your replacement, what skills, qualifications would you be looking for?

- Basic civil design experience
- AutoCAD experience
- Good fit with the company

6) How long did it take you to "get up to speed"? 1 yr for the basics, 2 years to work solo on projects.

7) Do you feel you have adequate training to get the job done? Yes

Is there any training you wished you had? Yes,

- Trenchless technologies, 3D design

8) How about continuing professional education? How do you meet the PE requirements

for CE? Nina is an EIT. She is taking the PE test this spring.

9) What are your long term goals now?

- 1 yr: Get PE license
- 5 yr: Prepare for working solo in civil engineering
- 10 yr: Look for private consulting opportunities

10) Do you feel adequately compensated for your efforts? (Y) / N maybe

- If No, besides money, what would you want in turn?

11) Have you ever used any formal PM software, Microsoft Project, Primavera, Suretrack, etc? Y / (N)

Do you feel it would help in your current job? N/A, Y / (N)

12) Based on past jobs, are there any PM techniques that could be beneficial to your job? (N/A) Y / N If Yes, please list techniques.

13) If you were thinking of leaving in the future, what would it take to get you to stay?

- More money
- Housing

14) What sort of topics related to AutoCAD and PM would you have liked to have seen while in school? None

Interview Form (Engineers)

Interviewee: ***Romeo Baylosis*** (Hired in Dec 99)

1) How satisfied were you with your interview process? 1 2 3 4 (5)

Did you have any concerns when you were hired? (Y) / N

If yes, what were your top two concerns (getting the job done, required skills, etc)?

1) Typical concerns for fresh at of college graduate filling an entry level position (benefits, salary, type of work)

2) Not concerned with ability to get the job done

2) Did you negotiate any part? Y / (N)

If yes, what were your top two issues?

3) How many other jobs did you apply for? None 1 2 3 4 (5+)

4) Did you discuss your long term goals? (Y) / N

If yes, what were your top two goals?

1) Get PE license

2) Learn the basics of civil design (learn how the industry operates)

5) If you were hiring for your replacement, what skills, qualifications would you be looking for?

- PE preferred
- 5 years experience with AutoCAD/field work
- Project management experience
- Good fit with the company

6) How long did it take you to "get up to speed"? 2/3 months for the basics, 2/3 years to work solo on projects.

7) Do you feel you have adequate training to get the job done? Yes

Is there any training you wished you had? Yes,

- In-house training on grading, drainage, 3D design

8) How about continuing professional education? How do you meet the PE requirements for CE?

- Attend outside training seminars. Goal is for 1 or 2 per year.

.

9) What are your long term goals now?

- 1 yr: See projects get built
- 5 yr: Moonlight in the industry to get a feel of business
- 10 yr: Look for private consulting opportunities

10) Do you feel adequately compensated for your efforts? Y / N (maybe)

If No, besides money, what would you want in turn?

- Longer vacation time

1**1) Have you ever used any formal PM software, Microsoft Project, Primavera, Suretrack, etc? Y /(N)**

Do you feel it would help in your current job? N/A,(Y) / N

- Scheduling purposes (both client and personal) Let clients know where the project stands, use the schedule to determine down time for taking vacations, etc.

12) Based on past jobs, are there any PM techniques that could be beneficial to your job? N/A, (Y)/ N If Yes, please list techniques.

- Critical path techniques as related to scheduling

13) If you were thinking of leaving in the future, what would it take to get you to stay?

- More vacation time/sick time
- More money
- Housing

14) What sort of topics related to AutoCAD and PM would you have liked to have seen while in school?

- Grading, site design
- Plotting

Interview Form (Engineers)

Interviewee: ***Grant Anderson*** (Hired in Nov 03)

1) How satisfied were you with your interview process? 1 2 3 (4) 5

Did you have any concerns when you were hired? (Y) / N

If yes, what were your top two concerns(getting the job done, required skills, etc)?

1) Would PLC have enough work?

2) What type of marketing plan does PLC use?

2) Did you negotiate any part? (Y) / N

If yes, what were your top two issues?

1) Salary (hired in at $75,000/yr)

3) How many other jobs did you apply for? (None) 1 2 3 4 5+

4) Did you discuss your long term goals? (Y) / N

If yes, what were your top two goals?

1) Become more of a project manager versus a design engineer

2) Get up to speed as quickly as possible in the area of site development (ie, water, sewer, grading design)

5) If you were hiring for your replacement, what skills, qualifications would you be looking for?

- Roadway design experience
- 3 years experience with AutoCAD
- Professional Engineering License
- BE able to work on multiple projects at once (10-15 projects)

6) How long did it take you to "get up to speed"? 6 months

7) Do you feel you have adequate training to get the job done? Yes

Is there any training you wished you had? No

8) How about continuing professional education? How do you meet the PE requirements for CE?

- Attend outside training seminars. Only had time for one in the past three years.

.

9) What are your long term goals now?

- Peace of mind (Sanity in the job)
- 1 yr: Less work, balanced work load
- 5 yr: Keep an eye out for a better opportunity

10) Do you feel adequately compensated for your efforts? Y / N (maybe)

If No, besides money, what would you want in turn?

11) Have you ever used any formal PM software, Microsoft Project, Primavera, Suretrack, etc? (Y) / N

Do you feel it would help in your current job? N/A, Y / (N)

12) Based on past jobs, are there any PM techniques that could be beneficial to your job?

N/A, (Y) / N If Yes, please list techniques.

- Change the proposal process (not so many exclusions)
- Use more standardized contract documents

13) If you were thinking of leaving in the future, what would it take to get you to stay?

- More vacation time/sick time
- More money
- More flexible schedule

14) What sort of topics related to AutoCAD and PM would you have liked to have seen while in school?

- Grading, site design
- 3D modeling

Interview Form (Office Manager)

Interviewee: ***Connie Nunley*** (Hired in 2001)

1) Did you have any concerns when you were hired? Y /(N)

If yes, what were your top two concerns (getting the job done, required skills, etc)?

- Did I have the right background to get the job done? (Ms. Nunley had more experience in engineer versus surveying)

2) Did you negotiate any part? Y /(N)

If yes, what were your top two issues?

- Although Ms. Nunley was happy with her offer, she did mention how important health care and vacation time was to her.

3) Did you discuss your long term goals? Y /(N)

What are your top goals?

- Security

4) If you were hiring for your replacement, what skills, qualifications would you be looking for?

- Book keeping skills
- Some knowledge of a program like Quick Books
- Knowledge of human resource type activities (Insurance, benefits, etc.)
- Strong personality and good self-esteem

5) How long did it take you to "get up to speed"? 1 month

6) Do you feel you have adequate training to get the job done? Yes

Is there any training you wished you had? Yes,

- An Microsoft Access type program to track projects
- Training in the area of insurance

7) Do you feel adequately compensated for your efforts?(Y)/ N

What are the extra perks with working at PLC?

- Ski pass, flexible schedule, benefit package

8) Have you ever used any formal Financial Software? (Y) / N

Do you fell it would help in your current job? N/A, (Y) / N

- Critical to getting the job done.

9) What are some of the more important aspects of running a small business?

- Everyone needs to have the same benefit package
- Start everyone out with a 90 day probationary period
- Start out with a small business loan versus personally secured loan
- Business insurance is expensive, but very important
- Have at least 90 days worth of payroll plus expenses available
- Have a line of credit and use it
- Start out with a part time support person (Stay at home mom)
- Keep all financial decisions with owner

Interview Form (Office Systems Manager)

Interviewee: ***John Fee*** (Hired in 2001)

1) What software systems are critical for running the office?

- Windows Small Business Server (w/appropriate # of licenses)
- Microsoft Windows Professional Edition
- AutoCAD LDD an/or Civil 3D design
- Back-up Exec software

2) What hardware systems are critical for running the office?

- Dell Server (min 300 G)
- Work Stations (min 80 G harddrive, 1 G RAM)
- Routers
- UPS Systems
- Xerox Plotter package

3) What type of information management system would be most useful for data management?

For a small company, the basic programs with the Microsoft Windows Professional edition will handle all the file management needs.

4) How long did take everyone to get up to speed after a major change in the computer system?

With the proper encouragement, it only takes a week to get everyone used to changes in the file management system.

5) If money was not important, what would be the perfect software and hardware combination?

Having a customized data management program is the ideal situation.

Interview Form (Vice President, PCE)

Interviewee: ***Mr. Luna*** (Hired in Jan 2003)

1. **How did you hear about the job?** Newspaper Ad

2. **What do you feel was the key to getting your job?** Experience working for Town of Frisco.

3. **How satisfied were you with your interview process?** 1 2 3 4 (5)

   Did you have any concerns when you were hired? Y /(N)

   If yes, what were your top two concerns (getting the job done, required skills, etc)?

4. **Did you negotiate any part? Y /(N)**

   If yes, what were your top two issues?

5. How many other jobs did you apply for?(None) 1 2 3 4 5+

6. Did you discuss your long term goals?(Y)/ N

If yes, what were your top two goals?

- Transition to Senior Project Manager as quickly as possible
- Part ownership of the company

7. If you were hiring for your replacement, what skills, qualifications would you be looking for?

- More interpersonal skills (you can't teach someone these traits)
- Lower technical skills (you can teach the CAD skills)

8. If you knew the company had the resources, would you consider more than one person to fill your shoes?(Y) / N

If yes, what would their specific job titles be?

Mr. Luna indicated that it would be nice to have another person to handle the overflow during the busy periods. However, because of the cyclic nature of work in the area, hiring another person would be based on whether the company picked up more long-term work.

9. How much practical PM have you had? (Some) Average A lot

10. How many classes in PM did you take? (None,) 1 2 3 4+

11. Did you receive any direction from the former office manager? (Y) / N

Most of Mr. Luna's training consisted of reviewing the billing procedures. He indicated that he needed more training on the details of the office.

12. Have you ever used any formal PM software? Y / (N)

If yes, which type did you use and did you think it was useful?

If no, do you think it would be useful in your current job? Y / (N)

Mr. Luna responded that the specific jobs PLC takes do not require any PM tracking. I did discuss some other uses for the programs. Mr. Luna did not seem to enthusiastic.

13. Do you consult with your engineers on Professional Development? (Y) / N

14. How important is PD? Somewhat Important Important (Very Important)

15. Do you feel you provide any mentorship? (Y) / N

Mr. Luna responded that he tries to take the engineers to as many meetings to observe how to interact as an engineer.

16. Do you have an understanding of your employee's long-term goals? Y / (N)

"Not as much as I should"

17. What are your long term goals?

- Ownership in the company
- Grow the company by a couple of engineers

18. How much latitude do you have any deciding salaries/positions?

Mr. Luna controls all the engineering side of house.

19. Are you involved in the long-term financial decisions of the company (ie. do you regularly sit down with Mr. Biggs to discuss numbers, etc?) (Y) / N

Meetings are on a ad-hoc basis.

Interview Form (Town of Vail)

The following information was obtained on Feb 1, 2007 in an interview with:

Chad Salli, P.E., Project Engineer
Town of Vail
1309 Elkhorn Dr.
Vail, CO 81657
(970) 479-2169
csalli@vailgov.com

1) What's the typical breakdown of the type of projects TOV awards (Firm-fixed, cost-plus, time and material, etc)?

Most of the TOV's contracts are Unit price due to the nature of the type of projects (i.e., road reconstruction and maintenance). The town maintains some flexibility by allowing up to a 30% contingency before a change order must be processed.

There is a $50,000 threshold for contracts before they are required to go out for competitive bid. The majority of projects are capital street improvements, road reconstruction, drainage and grading.

2) How important is project management in ensuring completion of contracts?

For the TOV, PM comes into play with most of their road projects. One of the biggest reasons is because of the level of design. The TOV does not typically pot-hole any of the utilities. Because of this, the TOV is responsible for solving a great deal of field issues concerning the utilities. Chad has spent up to 10/hr a day on some projects.

3) Which is more important, keeping cost from overrunning or bringing in a contract on time?

Depends… For small projects the focus is on getting the project done without a great deal of overrun. For larger streetscape projects the schedule rules. This is because of the tourist seasons. TOV only allows construction during the late spring and early fall. This coincides with the lowest tourist densities in the town and surrounding areas. TOV does not impose any liquidated damages. The contractors end up paying higher cost to remobilize on site.

Chad stated that over the past three years, he has only had one project come in over schedule and over budget. This was also his first project.

4) Do you use any formal software to track projects (Suretrack, Microsoft Project, etc)?

The TOV has Microsoft Project loaded on its computers. However, the majority of the staff does not use it. Chad's boss, the town engineer uses it occasionally but more as an organizational tool to track large scale development within the town to forecast staffing needs, etc.

The TOV does require that its contractors use a project management type program using the Critical Path Method for progress reports. They don't specify the type of software.

5) Do you ever outsource project management?
If so, what are your requirements for the project manager?

Not really. The TOV does have two contract employee serving as a PMs for the streetscape and parks and facilities projects. The streetscape PM has been on the job for at least three years. These positions were created based on needs and budget restraints from the town.

6) What type of qualifications do you look for in a Project Manager?

A PM should have a basic background in design and construction. No specific education in PM is necessary. Chad described some examples of having to much experience in only design or construction can cause problems out in the field.

Chad described the problems with finding good people in an area like Vail. Most applicants share a common goal of living and working in the mountains. Enjoying skiing, biking and hiking is compensation for the disparity in cost of living. Chad said he took a pay cut coming out here from Denver.

7) Is it important for a Project Manger to have some local knowledge?
If so, why?

No. Not so important in the big scheme of things. A person can learn about the finer points of the way things are done in a mountain community like Vail. Chad described his first conflicts with the town in regards to the removal of trees. Vail is not very happy with the loss of a single tree. Chad has learned the right ways to go about the process of removing or relocating trees.

8) Do you require project management skills and training for other positions?
If so what kind of positions?

Besides the engineering staff, the other positions in the TOV that involve a great deal of PM are the town's inspectors. Chad says that they try to give the inspectors a great deal of autonomy in their jobs. The level increases with experience. Their general feeling is to encourage them to take a common sense approach to a problem. Chad emphasizes safety as a major concern.

9) As a percentage of your total work week, how much time do you spend on project management?

During the construction seasons in the spring and fall, Chad spends about 70-80% of his time in the field. During the winter months this percentage drops to 20 to 30%. During these winter months, Chad spends time planning and programming for the upcoming construction seasons.

10) Have you taken any formal classes on project management? If so, how useful has the information been?

Chad has only had one class in his undergraduate program in PM. He was able to use some of the information in his first job working for a small construction firm in Denver. He has taken a couple of short courses, although not specifically in PM.

11) Does your job require you to take continuing education courses? If so, what type of courses do you look for?

No. The TOV does however have a training budget of up to $1500/pp/yr. Chad indicated that he was interested in classes on contract administration. The TOV only has one person, the town attorney, review the contract documents. Chad is concerned that things could be improved on.

12) Does the TOV always have to accept the lowest bid?

No. The TOV is able to use the Best Value approach in awarding contracts. They also have a clause that allows them to decline bids that seem to exceptionally low.

Because of the small number of firms, the TOV does not have a requirement for a percentage of work to go to minority firms.

13) Miscellaneous

I also discussed the issues of common goals and objectives. Chad was surprised to see goals for the TOV posted in every town office. The town is serious in ensuring everyone knows what the goals are and how they relate to every job (I will get a copy of the goals from their website).

I asked Chad about the PE and the push for requiring a master's degree for future applicants. He said that the states should require more continuing education credits for license renewal in lieu of a master's degree.

The last subject we talked about was running a small firm in the mountains. Chad said if he was in charge, he would have three overall goals: profitability, continued growth, and hiring employees whose goals are consistent with the overall goals of the company.

Interview Form
(Fritzlen & Pierce Architects)

The following information was obtained on April 24, 2007 in an interview with:

Kathy Helmers, Office Manager
Fritzlen and Pierce
130
Vail, CO 81657
(970) 479-2169
csalli@vailgov.com

1) What's the typical breakdown of the type of projects FP receives (Firm-fixed, cost-plus, time and material, etc)?

65% of projects are done by time & material. The other 35% are based on a percentage of construction cost. Typically 5-6% for commercial projects and 9-10% for residential projects.

2) How important is project management in ensuring completion of contracts?

PM is extremely important in our business. So much so that if we don not have contract administration over project, we ask for a release of liability form the client.

3) Which is more important, keeping cost from overrunning or bringing in a contract on time?

Depends. For large residential projects, cost is usually not an issue. With commercial projects or condos, the schedule is more important.

4) Do you use any formal software to track projects (Suretrack, Microsoft Project, etc)?

FP uses Gel Tech advantage for their accounting and financial management. No formal PM software. FP is upgrading to Vision, which does combine various parts of PM with marketing and client resource management.

5) Do you ever outsource project management? No
If so, what are your requirements for the project manager?

The two principals serve as PM along with one other architect. One principal handles up to 30 different projects.

6) Is it important for a Project Manger to have some local knowledge?
If so, why?

It is important that the PM understand the climate, geology, etc., but the PM can be trained to learn the basics.

7) What percentage of your contracts require engineering services?

Up to 95%of the contracts require some sort of engineering services.

8) Would it be more advantages to have a civil engineer in-house? If so, in what ways?

Yes, FP could take advantage of quick turnaround for changes in site plans. At the present FP uses a landscape architect for some projects. However, a civil still has to redo some aspects of his/her work. The only concern was whether the civil would stay busy. If the civil combined his/her time with PM then the arrangement would work.

9) General Comments

- FP is telling their clients to build now. Construction prices are continuing to rise by up to 15% a year.
- It takes as little as 3 months to complete the design of $1Million dollar residence
- Rates charged are 150/hr for principal and 120/hr for senior architect.
- Overhead rate is at 1.06%

APPENDIX C

BUSINESS PLAN FOR SUMMIT A & E

SUMMIT
A & E LLC

SUMMIT ARCHITECT & ENGINEERING, LLC
111 Main Street
Breckenridge, CO 80424

BUSINESS PLAN

Eric W. Waters, P.E., President
877 Airport Road #26
Breckenridge, CO 80424

Lance Weatherton, Vice-President
3456 Maple Drive
Fayetteville, AR 72015

Plan Prepared
by
Eric W. Waters
(Private and Confidential)

Copy 1 of 4

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SUMMIT

A & E **LLC**

EXECUTIVE SUMMARY

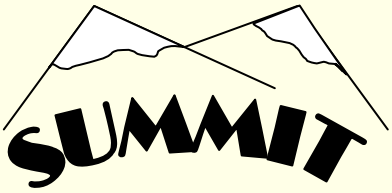
Summit Architect & Engineering (A&E) LLC is a start-up company to be established in January, 2008. The office will be located at 111 Main Street, Breckenridge, Colorado. The company is seeking $150,000 in working capital for the purpose of start-up operations and to cover estimated operating expenses for a six-month period.

Management. Summit A&E Inc. will be equally managed by its two Principals. Eric Waters has 14 years experience as a civil engineering officer in the United States Air Force. He is a registered Professional Engineer and holds three engineering degrees. Lance Weatherton is a licensed Professional Architect and has 14 years experience as a residential and commercial architect.

Current & Projected Market. Unlike the rest of the country, Summit county and the surrounding area are currently experiencing a boom in construction. The average sales price of all housing types in the County grew at an annual rate of nearly 18% from 1990 to 2000. According to the Summit County Housing Needs Assessment prepared in January 2005, the demand for new housing in Summit County by the year 2010 will be between 2900 to 3050 units. If the future housing units follow the current trend of 20% priced at over $500,000, over 500 units and their clients will need the services of Summit A&E Inc.

Loan Repayment. Repayment of the 15-year loan, plus interest can begin promptly within 30 days of receipt of funds. Early retirement of the loan is expected. The loan can be secured by the principals' home equity, which is currently valued at $300,000.

SUMMIT ARCITECT AND ENGINEERING



A & E **LLC**

I. ORGANIZATIONAL PLAN

Summary Description of the Business

Summit Architect and Engineering (A&E) LLC is a start-up company in Breckenridge, Colorado. The company provides architectural, civil engineering, and construction management services for Summit County and surrounding areas.

Mission Statement

Summit A&E's mission is to establish a strong and reputable firm that combines the professions of architecture and engineering to provide a complete service to our customers.

Business Model

The company offers a unique service to clients in Summit County and the surrounding area. No other company can match Summit A&E's cradle to grave approach for residential and commercial development. Our company is designed to walk the client through all phases of the design, engineering, and construction saving the client time and money.

Strategy

The company's growth strategy is to seek several large residential construction projects during the first years of business. During this time, the company will also accept clients in need of only civil engineering or architectural services. As our reputation grows, the company intends to move entirely towards clients in need of all of the services.

Facility

The company will lease a 1500 sq.ft. 3 room office on Main Street in Breckenridge, CO.

Products and Services

Summit A&E offers three types of professional service. First, the company is capable of providing design services for all residential and small commercial projects. The company will manage any other necessary elements such as interior and/or landscaping design. Next, the company can provide all the civil site design for the site to include drainage and grading, utility plans and erosion control plans. The company will manage any other necessary elements such as structural and/or geotechnical design. Finally, the construction management will be done in-house to ensure all design parameters are met and that the project is on time and within budget.

Company Profiles

The following are the descriptions of the two types of clients and the services that are typically provided.

1. **Residential Homeowners.** The company is targeting new residential construction for homes valued at over $500,000. As of 2005, 20% of the total values of Summit County homes were valued at over $500,000. The Summit County Housing Needs Assessment prepared in January 2005 estimates that by the year 2010, Summit County will need to add an additional 2800 to 3000 housing units to meet demand. If the percent of housing units over $500,000 holds, the potential client base can be estimated to be 600. This number does not include the hundreds of potential clients who wish to renovate their current property. This potential client base can easily keep a small company like Summit A&E very busy and very profitable for many years.

2. **Commercial Clients.** Summit A&E will seek out the design, engineering, and construction for smaller commercial developments such as small strip malls of less than 20,000 sq ft and small scale town and county municipal facilities. Due to the expected population growth, a great number of these projects will be needed to keep up with the increase in demands for goods and services.

Legal Structure

Summit A&E LLC is a corporation filed as a Limited Liability Corporation under the same name. Each of the two Principals will contribute $25,000 representing 50% equity into the company. The company will have a total of 500 shares of stock issued.

Provisions for Exit and Dissolution of the Company

The company will not issue any new stock for a period of five years. During that period, each Principal will still have the option of selling his stock to the other at the fair market value. At the end of the five year period, the Principals will evaluate the company to access the capability of expanding the business. Additional stock may be issued to employees or outside investors if expansion is agreed upon. From the five year point, bi-annual stock holder meetings will be held in January to determine by a majority if the business will expand and if new stock should be issued.

No dividends will be issued for the first three years. All retained earnings shall be applied to repayment of the initial loan. After three years, dividends will be paid out based on 25% of the company's profits for that year. One of the overall goals of the company will be the early repayment of the initial loan. The stock holders will take this goal into account in future discussions on business expansion.

A life insurance policy in the amount of $250,000 shall be taken out on each original Principal to be paid to the other Principal in the event of a Principal's death.

Management

The management duties of the company will be equally shared by both Principals. Eric Waters has over 14 years experience as a civil engineering officer in the US Air Force. During this period, he has effectively managed over $100 million dollars in Air Force construction projects. He holds a Bachelor's degree in civil engineering from the University of Arkansas, a Master's degree in engineering management form the University of Alabama, Huntsville, and a Doctor of Engineering Degree from Texas A&M University. He is a registered Professional Engineer in the state of Colorado.

Lance Weatherton has over 14 years experience in residential and commercial architectural design. He holds a bachelors degree in Architecture form the University of Arkansas. Over the past 10 years he has managed over $20 million in residential and commercial construction projects. He is a registered Professional Architect in the State of Arkansas.

Personnel

Initially, there will be four full-time employees – one architect, one engineer, one AutoCAD technician, and one office manager. An assessment of the current and future business level will be made at the end of each year to determine if additional employees are required.

1. Principal-President, Salary @ $75,000 per year
2. Principal-Vice President, Salary @ $75,000 per year
3. AutoCAD technician, Salary @ $50,000 per year
4. Office Manager, Salary @ $50,000 per year.

Personnel Duties

1. **President**
   a. Completes all civil engineering designs
   b. Solicits, interviews and hires new employees
   c. Negotiates new accounts
   d. Approves the purchases of new equipment and supplies
   e. Handles customer service issues
   f. Reviews and signs all checks

2. **Vice-President**
   a. Completes all architectural designs
   b. Solicits, interviews and hires new employees
   c. Negotiates new accounts
   d. Approves the purchases of new equipment and supplies

e. Handles customer service issues

f. Reviews and signs all checks

3. **AutoCAD Technician – reports to the President and Vice-President**

a. Completes CAD work as assigned by engineer and/or architect

b. Responsible for any surveying coordination

- Schedules surveys
- Prepares topographical maps

c. Manages all electronic files

d. Maintains company server

3. **Office Manager – reports to the President and Vice-President**

a. Answers phone

b. Responsible for bookkeeping functions of:

- Accounts receivable and accounts payable
- Payroll
- General ledger

c. Manages equipment and supplies

Employee Profile

All employees must be:

a. Hard working and neat in appearance

b. Good communicators

c. Team workers

d. Able to follow directives and be a quick learner

e. Dedicated to doing an outstanding job

f. Like working outdoors

Legal and Accounting

Legal

For all legal aspects of the business, the Company plans to retain the services of the Colorado-based Law Office of John Doe. Provide below is the company's contact information:

Law Office of John Doe
Principal – John Doe
1111 Main Street, Denver, CO
Office: 303-555-1212, Fax: 303-555-1313

Accounting

All bookkeeping will be handled by the Office Manager using the software, "QuickBooks Pro", by Intuit. Year end information will be sent to an outside accounting firm for audit and tax purposes. Microsoft Office will be used for word processing, developing spreadsheets, and preparing presentation and proposals.

Insurance & Security

Insurance

Carrier: State Farm **Agent:** John Doe

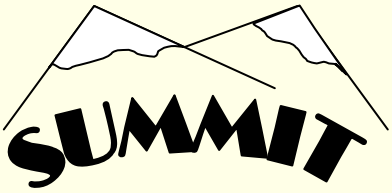
Type of Insurance:	Business/personal	250,000
	Deductible	5,000
	Liability	1,000,000
Vehicles:	Coverage	60,000
	Deductible	1,000
	Liability	1,000,000
Annual Premium:		10,000
	Monthly Premium	950
	Workers' Compensation 1.43 per/1k gross Payroll	

Security

The following measure will be used to protect the Company and its assets:

- The Company will maintain sensitive client information on its internal database.
- A web security software package will be used to protect the company website.
- A comprehensive background check will be performed for all new employees.
- The office will be protected by a surveillance system and alarm..

SUMMIT ARCITECT AND ENGINEERING



A & E **LLC**

2. MARKETING PLAN

Target Market

Who are my customers?

Residential

1. **Profile**

   Economic level – upper class

   Age - 35 to 60

   Income level – $200,000 and above combined family income

   Work – professional, business owners, business execs, upper management

   Habits – enjoy outdoor hobbies, seeking 2nd home in the mountains

2. **Location**

   The entire US is full of potential 2nd home owners interested in Summit Co.

3. **Market Size**

   Current estimates put the potential new clients at 500 to 600 over the next 5 years. An additional client base comes from remodeling existing homes.

Commercial

1. **Profile**

   Small strip malls less than 20,000 sq ft

   Remodels of existing stand alone structures

   Municipal facilities under 10,000 sq ft

2. **Location**

   The towns of Breckenridge, Frisco, Silverthorne, Dillon, and the numerous unincorporated areas of Summit Co.

3. **Market Size**

   The Summit County Housing Needs Assessment current estimates show an 18% increase in population or another 4,000 residents in Summit County over the next five years. Those numbers combined with a steady increase in the seasonal visitors to the area will drive the need for increased goods and services.

Competition

Summit A&E LLC. has no competitors in the area that offer the combined services of architectural design, civil design and construction management. However, there are quite a number of businesses offering individual services in each respective field. There are over 15 established architecture firms in Summit County. These firms typically subcontract their engineering needs to other local firms. Because there are only four established civil firms in Summit County, a great deal of the subcontracted work leaves the area. It is common practice for the architect to handle the construction management process based on the size of the project and the size of the firm.

Advertisement

Qwest DEX	White Pages – 1 line	No Charge
	Yellow Pages – 2 lines	No Charge
	½ Ad (per month)	$75
Summit Daily	Daily Circulation	12,000
	10% Spot Color Ad (4 x month)	$320
Vail Daily	Daily Circulation	15,000
	10% Spot Color Ad (2 x month)	$180
Summit Homes & Property Magazine	Weekly Circulation	12,000
	10% Spot Color Ad (per month)	$150
Company Website	Construction (In-house)	
	Website Maintenance per month	$200

The Company recognizes the importance of advertising outside the print media. The Company intends to join the Chamber of Commerce and the Summit County Business Association. The Company plans to attend as many business and social functions as possible in the local area. In addition, the Company intends to make use of Lance Weatherton's numerous contacts gained through working on large scale residences throughout the country over the past 10 years.

Location

The office will be centrally located on the main thoroughfare in Breckenridge. This location provides maximum exposure to the numerous seasonal visitors. The 1500 sq ft office will be divided into three rooms; a reception area, a large open work area, and a conference room. The office will be designed to present a picture of a professional and modern architectural and engineering firm. The large inviting conference room with the latest graphics display technology will be the focus in client interactions.

SUMMIT ARCITECT AND ENGINEERING

SUMMIT A & E LLC

3. Financial Documents

Summary of Financial Needs

Summit A&E LLC is seeking capital for start-up purposes. The Company has $50,000 in equity and is seeking a loan in the amount of $150,000 to accomplish its goals. See Loan Fund Dispersal Statement below for distribution of funds.

Loan Fund Dispersal Statement

Summit A&E will utilize funds in the amount of $200,000 for start-up of an architectural and engineering firm in Breckenridge, Colorado. The breakdown in funds is as follows:

Equipment	Plotter	$25,000
	Internal Network	$5,000
	Computers/Software	$24,000
Office Furniture		$18,000
Operating Expenses Shortfall		
(Projected 6 month break-even point)		$48,000
Loan Payments @ $1,600 per month (12 months)		$19,200
3-Month Payroll Reserve		$62,500
		Total $201,700

2008 Pro Forma Cash Flow Statement
Summit A&E

Page 1 (Jan through Apr)

For the Year 2008	JAN	FEB	MAR	APR
BEGINNING CASH BALANCE	200,000	100,317	72,634	44,951
CASH RECIEPTS				
A. Sales Receipts				8,405
1. Architectural Fees				3,600
2. Civil Engineering Fees				3,080
3. AutoCAD Tech Fees				1,725
B. Interest Income	0	0	0	0
C. Sale of long-term assets	0	0	0	0
TOTAL CASH AVAILABLE	200,000	100,317	72,634	53,356
CASH PAYMENTS				
A. Variable expenses				
1. Marketing	1,000	1,000	1,000	1,000
2. Bonuses	0	0	0	0
3. Travel expenses	300	300	300	300
4. Miscellaneous	200	200	200	200
5. Furniture/Equipment	72,000			
Total variable expenses	**73,500**	**1,500**	**1,500**	**1,500**
B. Fixed expenses				
1. Administrative fees - legal/acct.	50	50	50	750
2. Insurance	950	950	950	950
3. Office Salaries	20,833	20,833	20,833	20,833
4. Rent expense	1,500	1,500	1,500	1,500
5. Utilities	250	250	250	250
6. Vehicle lease	800	800	800	800
7. Miscellaneous admin expense	200	200	200	200
Total fixed expenses	**24,583**	**24,583**	**24,583**	**25,283**
C. Interest expense (vehicles, equipment)	0	0	0	0
D. Interest expense (land and building)	0	0	0	0
E. Federal income tax				
F. State income tax				
G. Capital asset purc, cash (land and building)	0	0	0	0
H. Capital asset purc, cash (vehicles, equipment)	0	0	0	0
I. Loan repayment	1,600	1,600	1,600	1,600
TOTAL CASH PAID OUT	**99,683**	**27,683**	**27,683**	**28,383**
CASH BALANCE/DEFICIENCY	100,317	72,634	44,951	24,973
LOAN TO BE RECEIVED				
EQUITY DEPOSITS				
ENDING CASH BALANCE	**100,317**	**72,634**	**44,951**	**24,973**

2008 Pro Forma Cash Flow Statement
Summit A&E

Page 2 (May through Dec)

MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
24,973	14,170	10,597	13,384	16,171	21,358	29,285	38,277
17,030	24,260	30,620	30,620	33,020	35,610	36,675	45,080
7,200	10,440	13,440	13,440	11,640	7,920	6,360	9,960
6,380	9,020	11,330	11,330	11,330	10,890	10,890	13,970
3,450	4,800	5,850	5,850	10,050	16,800	19,425	21,150
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
42,003	38,430	41,217	44,004	49,191	56,968	65,960	83,357
1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
0	0	0	0	0	0	0	4,000
450	450	450	450	450	300	300	300
200	200	200	200	200	200	200	200
1,650	**1,650**	**1,650**	**1,650**	**1,650**	**1,500**	**1,500**	**5,500**
50	50	50	50	50	50	50	50
950	950	950	950	950	950	950	950
20,833	20,833	20,833	20,833	20,833	20,833	20,833	20,833
1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
250	250	250	250	250	250	250	250
800	800	800	800	800	800	800	800
200	200	200	200	200	200	200	200
24,583	**24,583**	**24,583**	**24,583**	**24,583**	**24,583**	**24,583**	**24,583**
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
27,833	**27,833**	**27,833**	**27,833**	**27,833**	**27,683**	**27,683**	**31,683**
14,170	10,597	13,384	16,171	21,358	29,285	38,277	51,674
14,170	**10,597**	**13,384**	**16,171**	**21,358**	**29,285**	**38,277**	**51,674**

Three Year Income Projection
Summit A&E

	YEAR 1	YEAR 2	YEAR 3	TOTAL
INCOME				
A. Sales Receipts	261,320	438,960	495,870	1,196,150
1. Architectural Fees	84,000	121,920	122,640	328,560
2. Civil Engineering Fees	88,220	179,190	196,680	464,090
3. AutoCAD Tech Fees	89,100	137,850	176,550	403,500
B. Interest Income	0	0	0	0
C. Sale of long-term assets	0	0	0	0
GROSS PROFIT	**261,320**	**438,960**	**495,870**	**1,196,150**
EXPENSES				
A. Variable expenses				
1. Marketing	12,000	12,000	12,000	36,000
2. Bonuses	4,000	4,000	4,000	12,000
3. Travel expenses	4,350	4,350	4,350	13,050
4. Miscellaneous	2,400	2,400	2,400	7,200
B. Fixed expenses				
1. Administrative fees - legal/acct.	1,300	1,300	1,300	3,900
2. Insurance	11,400	11,400	11,400	34,200
3. Office Salaries	249,996	249,996	249,996	749,988
4. Rent expense	18,000	18,000	18,000	54,000
5. Utilities	3,000	3,000	3,000	9,000
6. Vehicle lease	9,600	9,600	9,600	28,800
7. Miscellaneous admin expense	2,400	2,400	2,400	7,200
8. Depreciation (assets)	9,600	9,600	9,600	28,800
Total operating expenses	**328,046**	**328,046**	**328,046**	**984,138**
NET INCOME	**-66,726**	**110,914**	**167,824**	**212,012**
Other Income (intereset income)				
Other Expense (intereset expense)	19,200	19,200	19,200	57,600
NET PROFIT (LOSS) BEFORE TAXES	**-85,926**	**91,714**	**148,624**	**154,412**
Federal Taxes		18860	31,848	50,708
State Taxes		8312	13,092	21,404
NET PROFIT (LOSS) AFTER TAXES	**-85,926**	**64,542**	**103,684**	**82,300**

Projected Balance Sheet
Summit A&E

Business Name:
Summit A&E Inc.

Projected for: January 1, 2008

ASSETS			% of assets
Current assets			
Cash		128,000	64.00%
Petty cash		0	0.00%
Accounts receivable		0	0.00%
Inventory		0	0.00%
Short-term investments		0	0.00%
Long-term investments			
Fixed assets			
Land (valued at cost)		0	0.00%
Buildings			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Improvements			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Equipment		54,000	27.00%
1. Cost	54,000		
2. Less acc. depr.	0		
Furniture		18,000	9.00%
1. Cost	18,000		
2. Less acc. depr.	0		
Autos/Vehicles		0	
1. Cost			
2. Less acc. depr.		0	
TOTAL ASSETS		**200,000**	**100.00%**

LIABILITIES		% of assets
Current liabilities		
Accounts payable	0	
Notes payable	0	
Interest payable	0	
Pre-paid deposits	0	
Taxes payable		
Accrued federal income tax	0	
Accrued state income tax	0	
Accrued payroll tax	0	
Accrued sales tax	0	
Payroll accrual	0	
Long-Term Liabilities		
Notes payable to investors	150,000	
Notes payable to others	0	
TOTAL LIABILITIES		
NET WORTH (EQUITY)		
Corporation		
1. Capital Stock		
2. Surplus paid in		
3. Retained Earnings	50,000	
TOTAL NET WORTH	50,000	

Projected Balance Sheet
Summit A&E

Business Name:
Summit A&E Inc.

Projected for: December 31, 2010

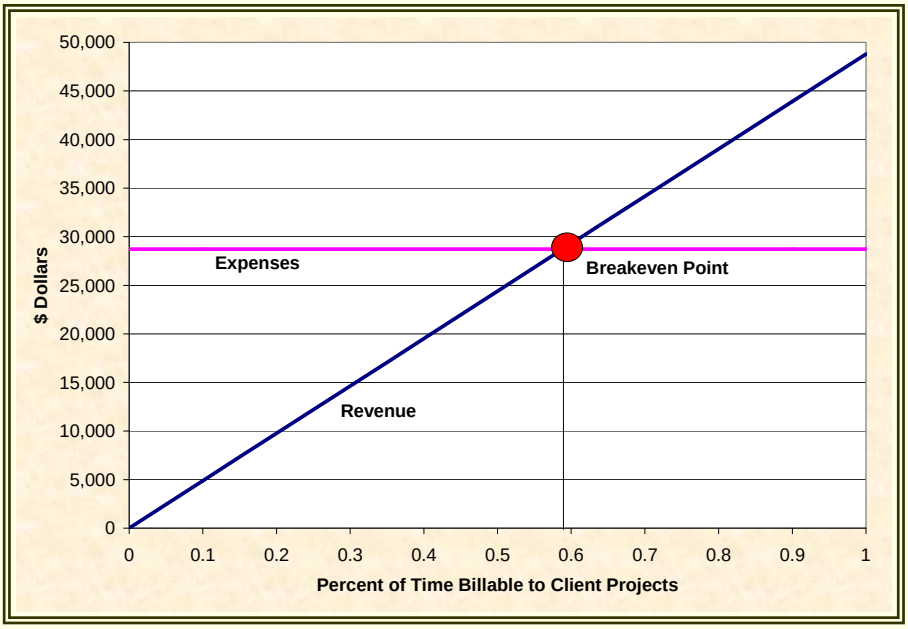
ASSETS			% of assets
Current assets			
Cash		236,850	78.26%
Petty cash		1,000	0.33%
Accounts receivable		31,000	10.24%
Inventory		0	0.00%
Short-term investments		0	0.00%
Long-term investments			
Fixed assets			
Land (valued at cost)		0	0.00%
Buildings			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Improvements			
1. Cost		0	0.00%
2. Less acc. depr.		0	0.00%
Equipment		21,200	7.00%
1. Cost	53,000		
2. Less acc. depr.	31,800		
Furniture		12,600	4.16%
1. Cost	18,000		
2. Less acc. depr.	5,400		
Autos/Vehicles		0	
1. Cost			
2. Less acc. depr.		0	
TOTAL ASSETS		**302,650**	**100.00%**

LIABILITIES		% of assets
Current liabilities		
Accounts payable	0	
Notes payable	0	
Interest payable	0	
Pre-paid deposits	0	
Taxes payable		
Accrued federal income tax	0	
Accrued state income tax	0	
Accrued payroll tax	0	
Accrued sales tax	0	
Payroll accrual	0	
Long-Term Liabilities		
Notes payable to investors	135,000	
Notes payable to others	0	
TOTAL LIABILITIES		
NET WORTH (EQUITY)		
Corporation		
1. Capital Stock		
2. Surplus paid in		
3. Retained Earnings	167,650	
TOTAL NET WORTH	167,650	

Breakeven Analysis

Based on Monthly Projections for 2008

Summit A&E



	Hourly	Monthly at 160 hours
Architect Fees	$120	$19,200
Engineering Fees	$110	$17,600
AutoCAD Tech Fees	$75	$12,000
Total for 100% Timed Billed to Client =		$48,800

Fixed Costs	=		$ 24,583
Variable Costs			$ 1,500
Loan Payment	=		$ 2,643
Revenue	=	At 59% Time Billed to Client	$ 28,726

SUMMIT ARCITECT AND ENGINEERING

SUMMIT A & E LLC

4. **Supporting Documents**

Eric W. Waters

P.O. Box 4636 Vail, CO 81658 Tel. 719-439-9164 ericwwaters@msn.com

Summary

Fourteen years as a civil engineer in the United States Air Force. Skilled in project management, civil design, AutoCAD, and office management. Lead program manager for over $200M in Air Force construction projects. Spent one-year working and evaluating a small civil engineering firm in Vail, CO.

Experience

F.E. Warren AFB, WY **1993-1995**

Design Engineer

Responsible for the project management of $M Base pavement indefinite quantity contract, $200K auto wash, $500K reconstruction of 2 miles of interior roads, and $330K reconstruction of 20th AF Headquarters parking lot.

Anderson, AFB, Guam **1995-1997**

Environmental Engineer

Responsible for cultural and natural resource management for 22,000 acres. Ensured new base projects met requirements of the National Environmental Protection Act.

AF Center for Environmental Excellence (AFCEE), TX **1998-2001**

Senior Program Manager

Managed over $20M in projects supporting over $2B in Air Force programs. AFCEE Military Manager of the Year for 2000.

US Air Force Academy, CO **2001-2004**

Assistant Professor of Civil Engineering

Managed five faculty civilian and military members as Chief of the Construction Division. Taught courses in AutoCAD and Architectural Design.

Personal Strengths

Excellent organizational and communication skills

Strong management and leadership training

Strong knowledge base in principles of project management

Actual experience in civil site design and architectural design

Education

B.S. in Civil Engineering	University of Arkansas	**1988-1993**
M.S. in Engineering Management	University of Alabama, Huntsville	**1997-1998**
D.E. in Project Management	Texas A&M University	**2004-2007**

Affiliations

Registered Professional Engineer in Wyoming and Colorado

Member of Society of American Military Engineers

Member of American Society of Civil Engineers

Lance A. Weatherton

P.O. Box 4636 Vail, CO 81658 Tel. 719-439-9164 ericwwaters@msn.com

Summary

Project Manager at Miller Boskus Lack Architects in Fayetteville, Arkansas from June 2000 – Present.

Designer / Project Manager at Cromwell Architects Engineers in Fayetteville, Arkansas, From 1993 – June 2000.

Experience

Commercial

Moberly Office Park, Bentonville, Arkansas
Northstar Office Building, Fayetteville, Arkansas
Fletcher Chevrolet, Springdale, Arkansas
Fletcher Honda, Bentonville, Arkansas
Cornerstone Building, Fayetteville, Arkansas
Live Oak Development Warehouse, Springdale, Arkansas
Sunset Plaza, Springdale, Arkansas
Arvest Bank, Springdale, Arkansas
United Bank, Rogers, Arkansas
Fountain Plaza, Bentonville, Arkansas
CEI Engineering Office Building, Bentonville, Arkansas
Northwest Arkansas Business Center, Lowell, Arkansas
One Corporate Square Renovations, Fayetteville, Arkansas
Sage House, Fayetteville, Arkansas
Cromwell Architects Engineers Projects:
Prairie Grove Library, Prairie Grove, Arkansas
City of Fayetteville Water Operations Center, Fayetteville, Arkansas
Bank of America Building BER, Fayetteville, Arkansas
Procter & Gamble New Office Building, Fayetteville, Arkansas
Procter & Gamble Renovation, Fayetteville, Arkansas
Eye Center of Northwest Arkansas, Fayetteville, Arkansas
McKinney Real Estate Remodel, Fayetteville, Arkansas

Restaurant/Bar

Shogun Japanese Steakhouse, Bentonville, Arkansas
Eddie Haskell's at Pinnacle Point, Bentonville, Arkansas

Medical

VA Pharmcy Renovation, Fayetteville, Arkansas
Butterfield Trail Village, Fayetteville, Arkansas
Sugar Creek Animal Hospital Addition, Bentonville, Arkansas
Cromwell Architects Engineers Projects:
VA ICU Renovation, Fayetteville, Arkansas
Washington County Health Clinic, Fayetteville, Arkansas
Bates Medical Center Same Day Surgery, Bentonville, Arkansas
Conway Regional Women's Center, Conway, Arkansas
Washington Regional Medical Center Renovations, Fayetteville, Arkansas

Educational

Central Junior High School Football Facility, Springdale, Arkansas
University of Arkansas Printing Services, Fayetteville, Arkansas
Children's House, Fayetteville, Arkansas
Cromwell Architects Engineers Projects:
Carnall Hall Renovation, University of Arkansas, Fayetteville, Arkansas
Alternative Pest Control Building, University of Arkansas, Fayetteville, Arkansas
HPER Pool Renovation, University of Arkansas, Fayetteville, Arkansas
Archeological Survey Building, University of Arkansas, Fayetteville, Arkansas
Razorback Stadium ADA Ramp, University of Arkansas, Fayetteville, Arkansas

Religious

Cromwell Architects Engineers Projects:
Central United Methodist Church, Fayetteville, Arkansas
Central United Methodist Church, Rogers, Arkansas
St. John's Episcopal Church, Helena, Arkansas
St. Paul's Episcopal Church, Fayetteville, Arkansas
Wesley Building Renovation, Fayetteville, Arkansas
Faith Outreach, Helena, Arkansas
Trinity Episcopal Church, Ft. Smith, Arkansas
Bentonville Church of Christ, Bentonville, Arkansas

Fitness/Rehabilitation

Fayetteville Athletic Club, Fayetteville, Arkansas
HealthSouth Addition to Fayetteville Athletic Club, Fayetteville, Arkansas
HealthSouth TFO at Mid-Cities, Bentonville, Arkansas
Wal Mart Fitness Center, Bentonville, Arkansas

Residential

Fowler Residence, Fayetteville, Arkansas
Hillcrest Residence, Fayetteville, Arkansas
Weatherton Residence, Springdale, Arkansas
White Residence, Fayetteville, Arkansas
Baker Residence, Conway, Arkansas
Moore Residence, Cozumel, Mexico
Stone Condo Renovation, Aspen, Colorado
Paris Residence, Centerton, Arkansas
Cromwell Architects Engineers Projects:
Stone-Phillips Residence, Rogers, Arkansas
Worden Residence Addition and Remodel, Fayetteville, Arkansas
Greenwood Residence Remodel, Fayetteville, Arkansas
J. Hampton Townhouse, Rogers, Arkansas
D. Crowell Residence, Rogers, Arkansas
Campbell Residence, Fayetteville, Arkansas
Smith Residence, Elkins, Arkansas
M. Crowell Residence, Rogers, Arkansas
Gage Residence, Fayetteville, Arkansas
Sparks Residence, Rogers, Arkansas
Fehlig Residence, Rogers, Arkansas

Master Planning

Woodbury, Fayetteville, Arkansas
Timberlake Office Park, Fayetteville, Arkansas
Fayetteville Athletic Club, Fayetteville, Arkansas
Cromwell Architects Engineers Projects:
Central United Methodist Church, Fayetteville, Arkansas
Procter & Gamble, Fayetteville, Arkansas

Education

Bachelor of Architecture	University of Arkansas	**1988-1993**
Study Abroad, Rome Design Studio	Rome, Italy	**1992**

Affiliations

Associate Member, American Institute of Architecture

Member, Construction Specification Institute

APPENDIX D

LESSON PLANS FOR THE US AIR FORCE ACADEMY

UNTIED STATES AIR FORCE ACADEMY
CIVIL ENGINEERING 464
ARCHITECTURAL DESIGN

LESSON ONE

PRELIMINARY SITE DESIGN

BACKGROUND: Vail Resorts (VR) needs to upgrade their race course timing buildings. VR's current buildings are over 20 years old and do not provide any restroom facilities. VR has contracted with a local architectural firm, Franklin Templeton and Pierce (FTP), to provide new designs and project oversight for the new construction. FTP has now sub-contracted with you to provide the basic civil design to include:

- Determine finish floor elevation to minimize cut and fill
- Provide positive drainage around the new building without removing any trees
- Relocated existing dirt haul road to the north

Existing Site: In order to begin the project, you must have a current topographic map of the project site. To accomplish this you must:

- Provide the surveyors with a map of the site and the boundaries of the survey. ***See Attachment 1*** for the project site map. *Note 1
- Contact the local utility companies to locate the existing services. *Note 2
- Use the surveyor's information to build a topographic map of the site. *Note 3

Open: CE464/Lesson1/Site

This drawing contains all the data for the project. In order to make sense of the drawing, you will need to freeze out certain layers.

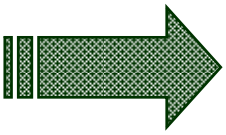
Type in **LMAN** on the command prompt. Select **Survey Info** and hit restore.

The command LMAN stands for Layer Manager. This is one of the most useful commands when working with large drawing files. This command allows you to store various layout stages to better facilitate the design process. Basically it works by saving your layer states (Off/On, Thaw/Frozen, Color, Lineweight, etc.) associated with designing different parts of your design such as grading and drainage, utility design and erosion control. For this step, the Survey Info state displays only the information necessary to complete the topo (points and breaklines). For more information on the LMAN command please see the **Practice** below or, as always, use the AutoCAD's help function.

Type in **LMAN** on the command prompt. Select **Existing** and hit restore.

A topo of the site was built by using CAD's **Terrain Model Explorer**. This feature allows you to create surfaces from a variety of sources. The 3D surface created is shown in white and is on the TOPOSRF-VIEW layer (After viewing, freeze this layer). The topo lines are now more visible in the drawing. The last step in building the existing site view was to add the utility lines, hatch the major features and add any descriptive notes.

This brings you to the first exercise. You will create a surface for a residential site.



Go To Exercise One

PRACTICE

Modify LMAN: First zoom into the drawing by using the drop down menu (VIEW/NAMED VIEWS/VIEW 1). Using the Layer Property Manager modify the POINTS layer by changing the color from 15 to Blue. To save this change you must go back to LMAN and resave the current settings (Type LMAN, select Survey Info, and select Save). Because the LMAN command works on CAD's text files it should also be noted that any new layers created must also be added by resaving the state through the LMAN command.

NOTES

1) The preliminary site map can come from previous CAD files or just a simple drawing based on an aerial shot or topo provided by sites such as Google Earth.

2) Many times the local utility companies will not provide this service for projects under design. They will only come locate just before the construction begins. You have several choices at this point. First, most towns have maps showing existing utilities. Use these with caution, and then field verify for any discrepancies. Second, the surveyors should locate all manholes, valve covers, etc. Use this information to provide approximate locations. Field verify and adjust before construction. Third, hire an independent contractor to locate the utilities. For critical locations, you can have the area pot-holed to determine exact location and depth.

3) This step is usually accomplished by the surveying staff. They build the topo based on data collected in the field. The surveyor will shoot spot elevations based on a grid like pattern. In addition, points will be shot along all major features such as road edges, road centerline, drainage paths, bldg corners, culverts, etc. These are used to create breaklines.

Proposed Site: From the previous exercise, you now have a better understanding of how this existing site was built. To complete the preliminary site design for FTP, the following steps outlines the typical process used by the engineer.

Re Open: CE464/Lesson1/Site

Take a minute to review the existing site. Note that the existing buildings do not have sewer or water service. Also take note that the bldg location is constrained by the existing ski slope to the west of the buildings.

Type in **LMAN** on the command prompt. Select **PROPOSED NEW BUILDING STEP ONE** and hit restore.

STEP ONE: DETERMINE CONFLICTS

The building's new footprint was X-Ref into the dwg from the architect's files. The location is typically set by the Architect/Client. Unless major conflicts are anticipated, the engineer is not involved in this step.

Potential Conflicts:

Sanitary Sewer: The existing sewer line crosses underneath the planned NW corner of the building. An investigation determined that the sewer line is an 8" pressurized main. Rerouting this service will be an expensive proposition. The closest manhole with the required drop in elevation to the new building is in the parking lot of the ski school building.

Water: The water line that is to the west of the building is non-potable water used in snow making operations. The existing snow hydrant within the new bldg footprint will have to be removed and relocated. (Not the responsibility of the engineer). New water service can come from the service to the ski school bldg. The location of this line is not shown on this view.

Shallow Utilities: The existing and telephone lines will have to be replaced. The new service locations are not typically set by the engineer. The architect usually will locate the exterior tie-ins for the bdg. The utility companies will then be involved in determining the new connections points and service lines.

Site Topography: The SW bldg corner holds the key in setting the correct vertical position of the building. As you can see, the new corner of the building sits at the base of the ski hill. Although the finished floor can be lower than the existing ground at this point, the foundation walls will need to be built high enough to allow for snow build-up and protection for water infiltration during the winter months. During the summer, drainage must be diverted around this SW corner to promote positive drainage. It is also important to note that the footing depth must be at least 4 feet below ground level to account for the frost depth. A geotechnical engineer will need to be involved in this step to determine soil bearing capacity.

Miscellaneous: There are several other features that need to be addressed. First, the tree to the south of the bldg must be preserved. Second, the existing haul road will have to be relocated to the north along with removing part of the asphalt drive to the east of the building. Finally, the height of the building's two doors on the north side need to be considered in setting the finished floor as they will need to be raised off the ground to accommodate for snow pack.

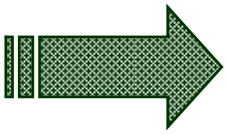
STEP TWO: DETERMINE BUIDING FOOTPRINT ELEVATIONS

Type in **LMAN** on the command prompt. Select **STEP TWO** and hit restore.

The outline of the bldg has been provided. In addition, flow arrows have been added to give the user an idea of how the flow should be diverted away from the bldg. The topo suggests that the dirt haul road can be easily moved to the north to accommodate the new structure. However, at this point, the dirt service road will be ignored to concentrate on the area directly around the bldg.

Determining the elevations for the building corners is an iterate process. First go to **VIEW/NAMED VIEWS/View 3**. For the new race bldg, the most important point was the SW corner. This point was set at 8233 needed in order to be above the finished grade. The rest of the points were created due to the fact that the majority of the bldg fell within the 8230 to 8228 contours.

Once the initial elevations were determined, the next step was to build a grading plan for the building. The easiest way to begin this process is to use the features of the grading menu. At this point, you will use the information for Lot1 to create a grading object.



Go To Exercise Two

Type in **LMAN** on the command prompt. Select **STEP TWO – A** and hit restore.

The first grading object was created with the fill slope set at a 6:1 ratio. The results show a number of things:

- EAST SIDE: No grading problems
- SOUTH SIDE: A good flow line exists without interfering with the tree
- WEST SIDE: Not enough grade break (Flowlines highlighted by REVCLOUDS)
- NORTH SIDE: No grading problems

The only problem area is with the west side. There are a number of solutions. First, the west side can be raised; however, this solution would most likely lead to an increase in the amount of fill needed around the entire building. Second, an acceptable flowline can be created by using a minimum slope ratio of 2:1 from the buildings edge. Another corresponding cut will be needed on the opposite side of the newly established flowline in order to match the existing surface. This is the solution used by the engineer in this design.

STEP THREE: USE FLOWLINE TO ESTABLISH A FINAL GRADE AROUND THE BUILDING

Type in **LMAN** on the command prompt. Select **STEP THREE** and hit restore.

A flowline on west side of building was created 8’ from the buildings edge. Points were established along the flowline by ensuring a minimum of 2:1 cut was used. Because of this minimum requirement, the note indicates that the slope varies. A 3:1 slope was used for the corresponding cut on the opposite of the flowline.

Additionally, the flowline was continued around the building using the grading objects as a guide. The last item in this step was to adjust the exact elevations around the buildings to account for items such as the two doors on the north side of the building.

Type in **LMAN** on the command prompt. Select **STEP THREE – A** and hit restore.

The finished product is displayed. Notice the flowline dives back towards the northeast corner. Because of the existing elevations and the need to move the haul road to the north, it was decided to provide a straight grade of no less than 2 percent from the buildings north edge. This straight grade would also be used in the relocation of the haul road. The next step will describe the rest of the process to finish this project.

STEP FOUR: RELOCATE HAUL ROAD AND PROVIDE FINISHED UTILIITY PLANS

Type in **LMAN** on the command prompt. Select **STEP FOUR** and hit restore.

There are several steps involved in relocating the existing haul road. Thee steps are addressed in LESSON 2: SITE DESIGN (Alignments and Profiles).

This view shows that the road was designed with a 2% grade from right to left in relation to the buildings north edge. The existing pressurized sewer main still goes through the NW corner. The geotechnical and structural engineers design the buildings footings to accommodate the existing line. The buildings new water and sewer system were added on the east side of the building. The locations of these services were determined by the mechanical engineers drawings. An 8” roof and floor drain PVC pipe was necessary to carry the flows under the new road and existing sidewalk. The drawing also shows how far back to remove the existing asphalt on the east side.

END OF LESSON ONE

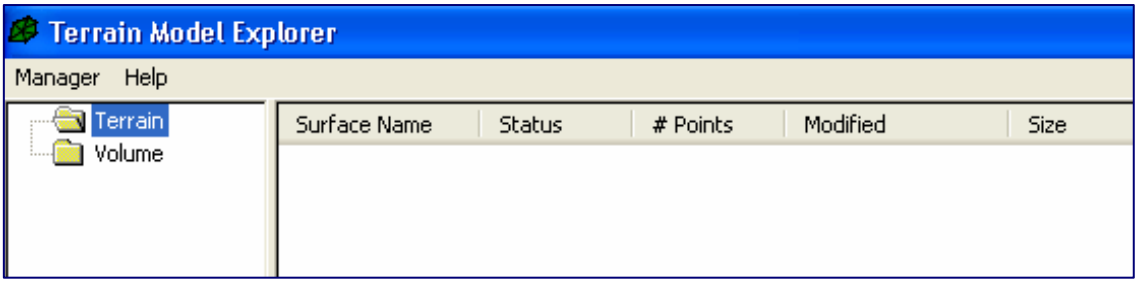
CAD **EXERCISE ONE**: Building a Surface

CAD Open: CE464/Lesson1/Exercise One

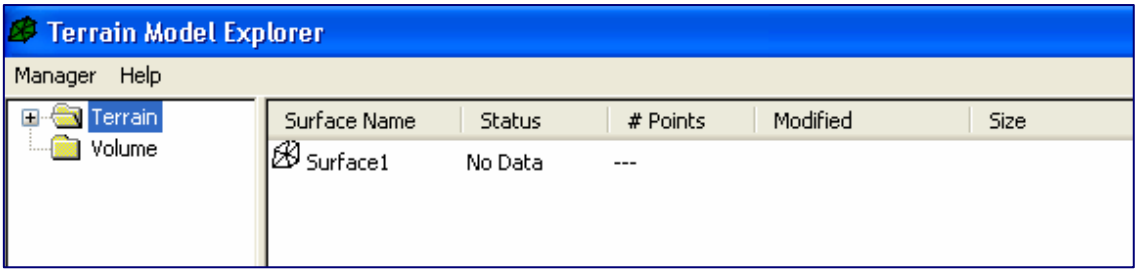
This drawing contains boundary lines and survey points of a typical lot measuring 1.25 acres. This represents the information you would receive from a typical survey. Information on the existing utilities is not provided.

STEP ONE: SET UP TERRAIN MODEL EXPLORER

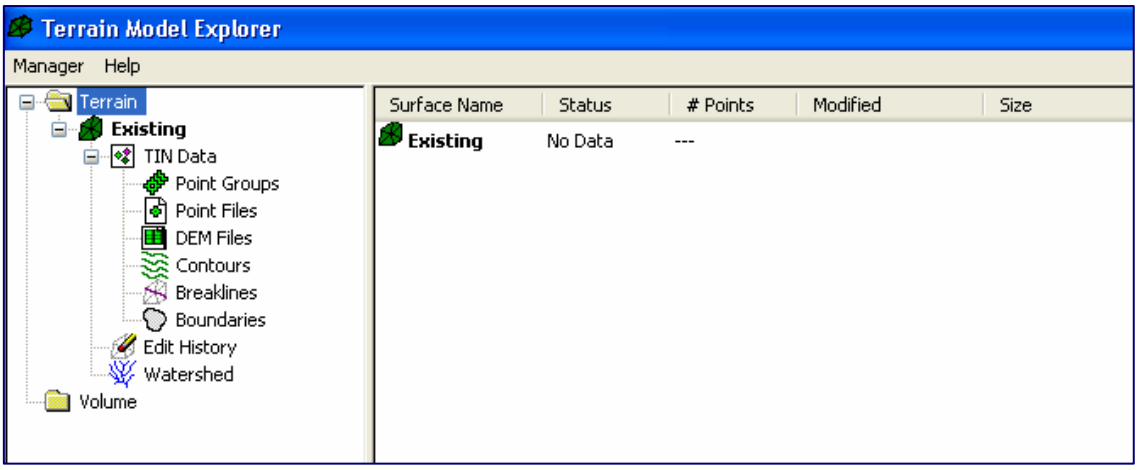
Open Terrain Model Explorer from **Terrain** drop down menu.



Right click on Terrain and select **Create New Surface.**



Right click on Surface1 and select **Rename**: Type in Existing. Click OK. Right Click on Existing and select **Open (Set Current)**. Expand Existing folder.



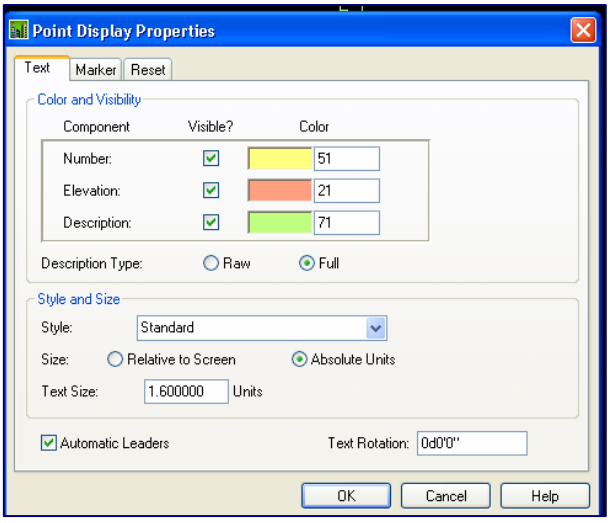
The Tin Data shown indicates all the data that can be used to build a surface. For this exercise we are only going to use Point Groups, Breaklines and Boundaries.

STEP TWO: ADD BOUNDARY

Right click on Boundaries and select **Add Boundary Definition**. The command line will prompt you to select polyline for boundary. Select lot boundary. Type in Lot 1 for Boundary Name. Hit enter to select <Outer> default. Hit enter to select <Yes> to except make breaklines along edges. Hit enter to exit the command.

STEP THREE: CREATE AND ADD BREAKLINES

Breaklines are necessary to define unique aspects of a site such as roads, ditches, buildings, etc. Without them, the surface could not be accurately created.



Minimize Terrain Model Explorer. Go to View/Named Views/View 1, select **Set Current** and click OK.

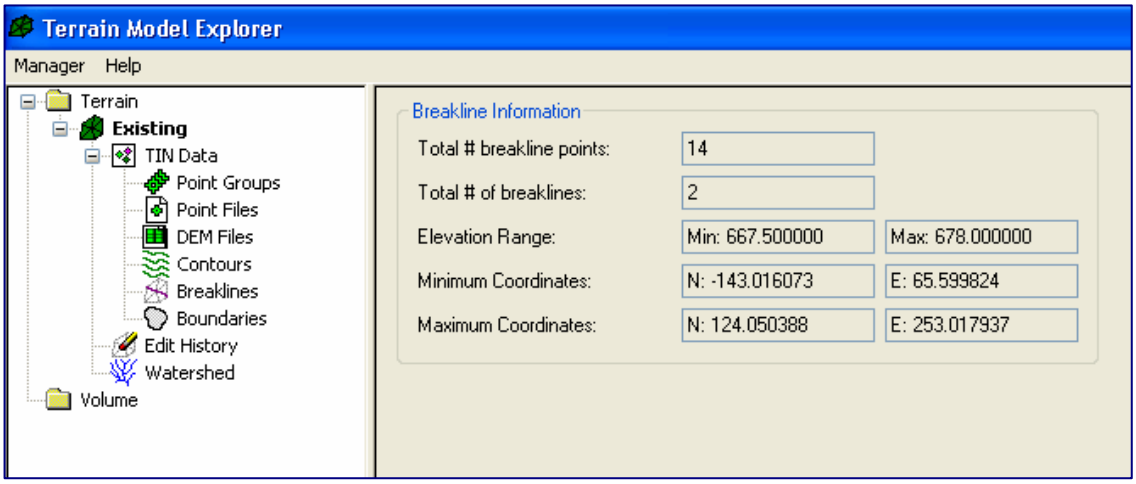
Select point 46 and right click. Select **Display Properties.** The three pieces of information displayed are: Point number, Elevation (in ft for this dwg), and Description. Common descriptions can be found in Appendix A. For this point the FL stands for Flowline. The properties box allows you to change various aspects of the points to make the drawing more readable.

Make Ditch layer current. Type in **3dpoly** on the command line. Beginning with point 46, connect points 46 – 17 – 18 – 19 – 20 – 21.

Note: Make sure you have Snap turned on and Node selected.

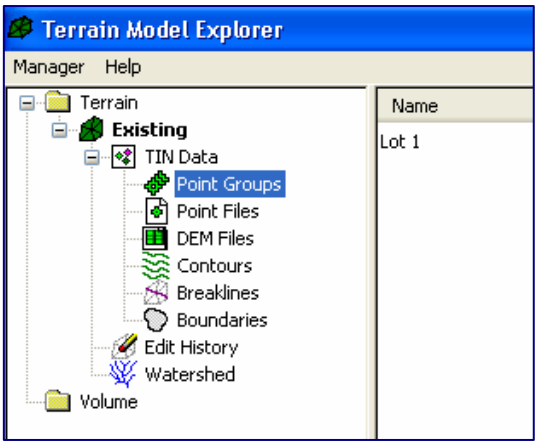
Next, go to View/Named Views/View 2, select **Set Current** and click OK. Type in **3dpoly** on the command line. Beginning with point 17, connect points 17 – 22 – 23 – 24 – 25 – 26 – 27 – 28.

Reopen Terrain Model Explorer. Right click on Breaklines and select **Define by polylines**. Type in **Ditch** for Description. Select both breaklines. Select No for delete existing objects. The Terrain Model Explorer should show the following information:



In the drawing, CAD automatically created a new layer, Existing-TO-SRF-FLT, for the breaklines. Note: By keeping the existing breaklines, you can make edits more easily.

STEP FOUR: ADD POINT GROUP TO EXISTING SURFACE

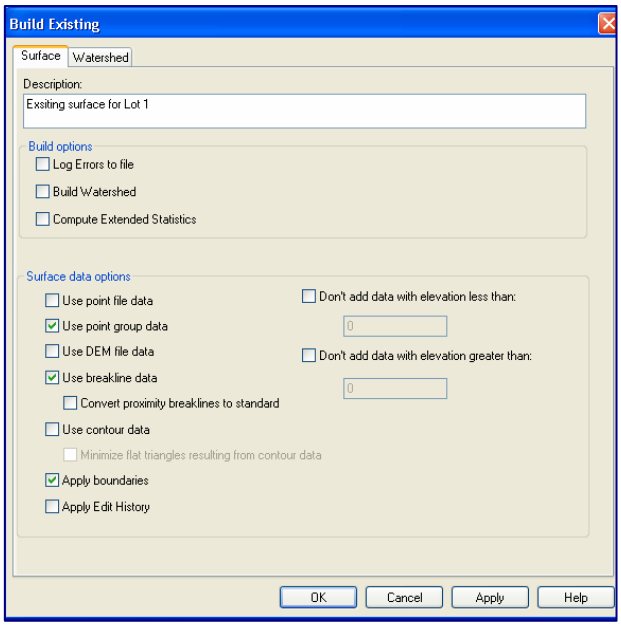


Most surveyors will build point groups into the drawing in order to make better sense of all the surveyed points, especially for large complex sites. In this drawing only one point group was created which makes it a simple task to add into the surface information. In the Terrain Model Explorer, right click on Point Groups and select **Add Point Group.** From the drop down menu select Lot 1 from the list and click OK.

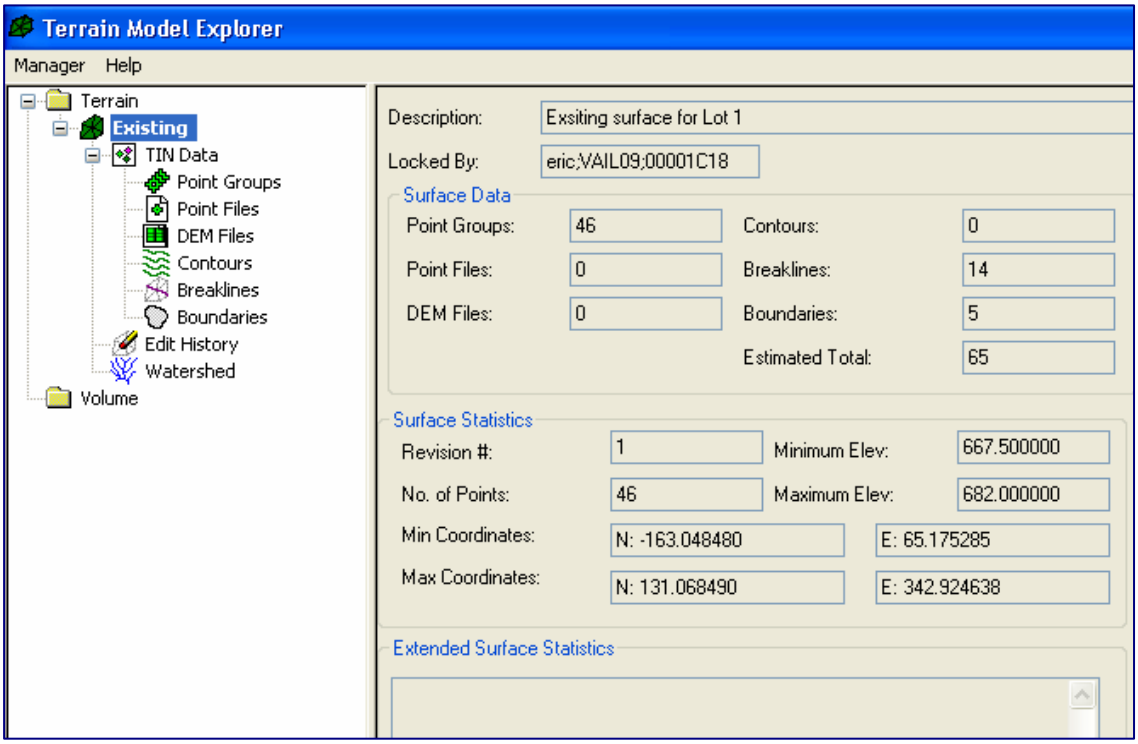
STEP FIVE: BUILD A SURFACE

In the Terrain Model Explorer, right click on **Existing,** and select **Build…** The Build Existing Dialogue box will be opened. Type in "Existing surface for Lot 1" for Description. Under Surface data options, check the following: Use point group data, Use breakline data, and Apply boundaries. Once complete, click OK.

Click Ok once prompted after CAD is finished building surface.

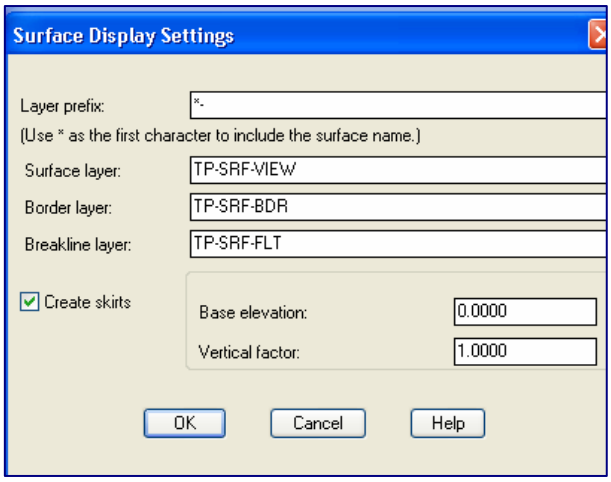


Terrain Model Explorer should display the following information:



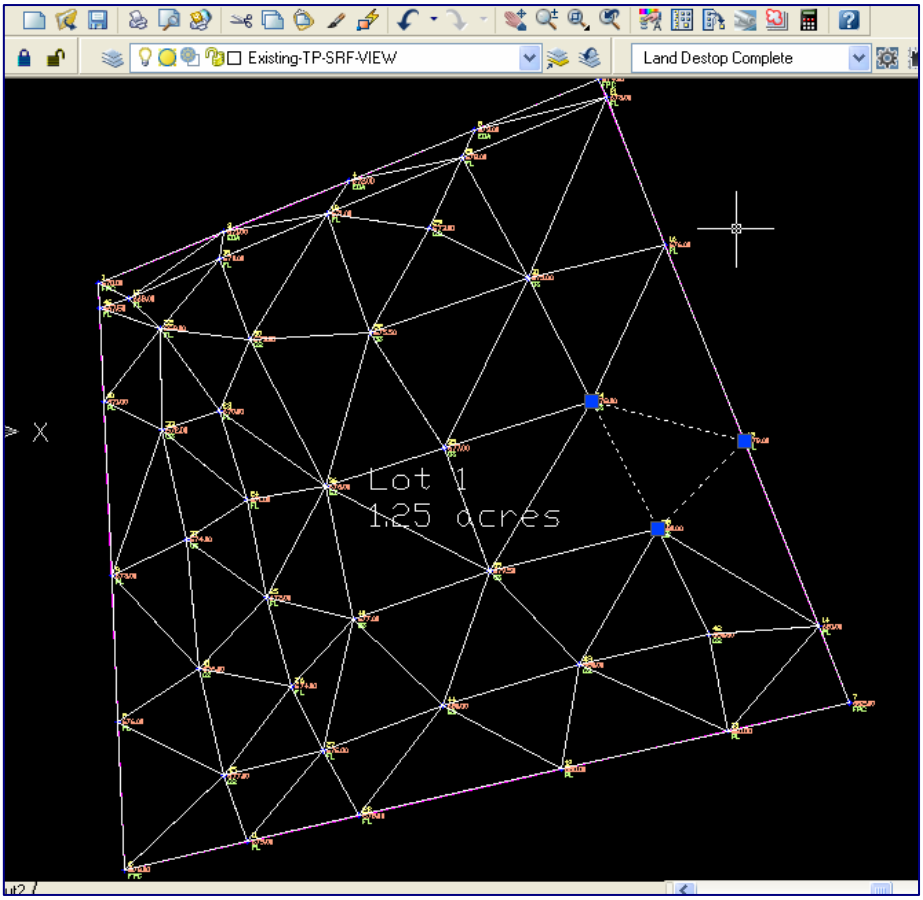
STEP SIX: DISPLAY SURFACE AND CREATE CONTOURS

Minimize the Terrain Model Explorer. From the Drop down menu, choose: **Terrain/Surface Display /3D Faces.**

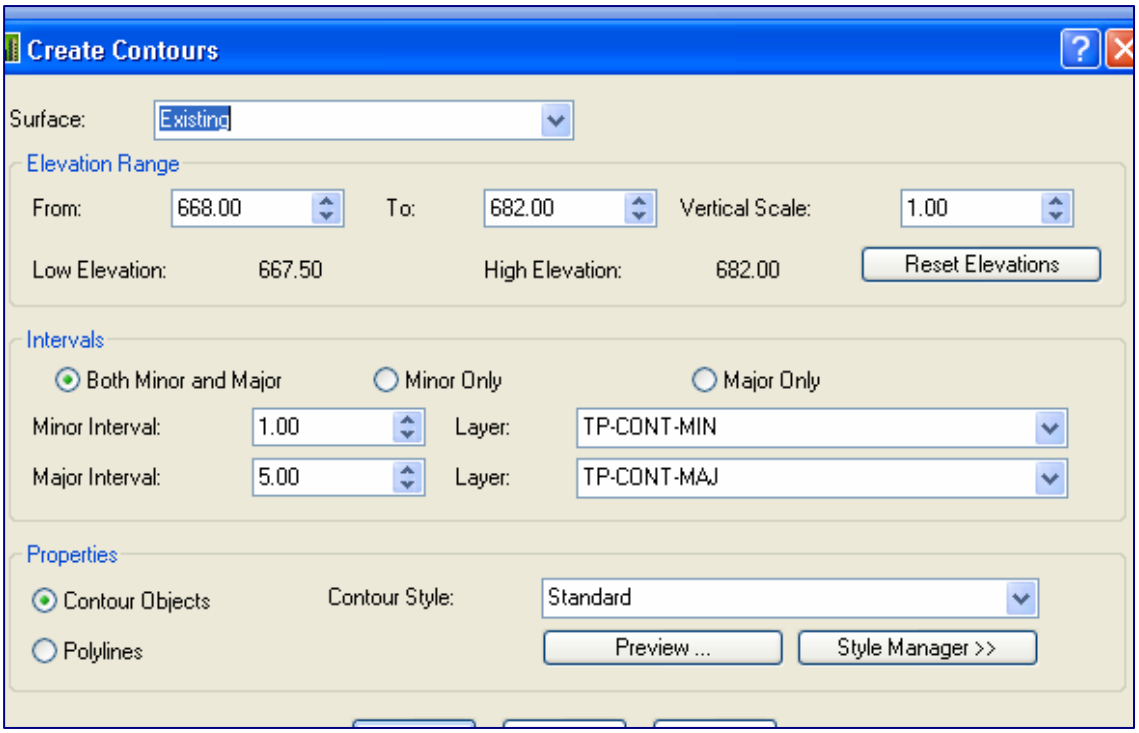


Make sure you put an asterisk (*) in the Layer prefix box. Click OK to accept the other default information. The command prompt will ask you to Erase old BORDER/SKIRT view. Hit return to accept the default <Yes>. Hit enter again to accept the default <Yes> for Erase old surface view. CAD will then create 3D triangles based on all the information provided.

These new 3D faces are created on the layer Existing-TP-SRF-VIEW.



Form the Terrain Drop down menu, choose Create Contours to bring up the Create Contours dialogue box.



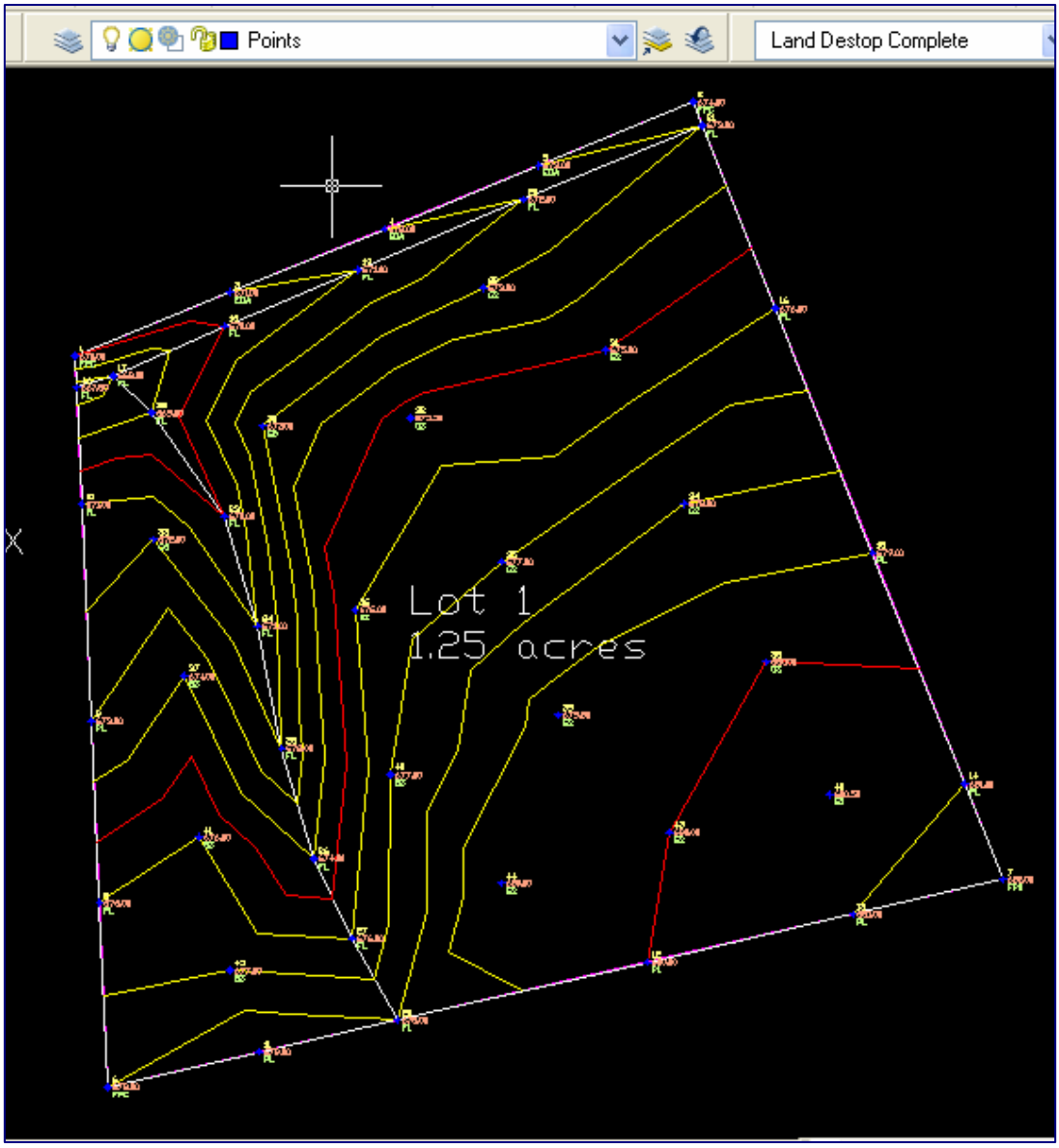
Ensure that Surface shows Existing. CAD pulls all the other data from the drawing. Click OK to accept all of the defaults. Hit renter to accept Erase old contours default <Yes>. Contours are created on the EXISITING-TP-CONT-MIN and …MAJ LAYERS. Now freeze
the 3D faces and change the Min layers to yellow and the Maj layers to red.

Congratulations!! You have created 3D counters on the existing site.

> Note: Surfaces created in CAD are not perfect. Exact volumes, drainage path, etc can not be assumed to be 100% accurate. A good engineer is careful not to make this mistake.

Before continuing, ensure your drawing matches the solution shown on the following page.

Save: CE464/Lesson1/Exercise One Solution-LAST NAME



END OF EXCERCISE ONE

Return to Page 4

CAD **EXERCISE TWO**: Grading Objects

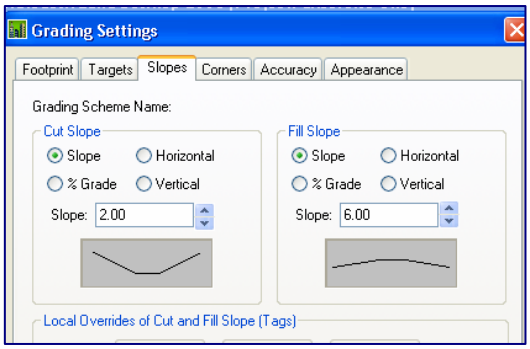
CAD Open: CE464/Lesson1/Exercise Two

Go to VIEW/NAMED VIEWS/VIEW 3. A 2600 sq ft house has now been horizontally and vertically sited on Lot 1. The 3D polyline represents a slab on grade foundation with an elevation of 681'. This can be verified by checking the properties of the polyline and or selecting the line and floating the cursor over the grips. The X, Y and Z coordinates are displayed below the command line.

STEP ONE: DETERMINE SLOPE GRADE SETTINGS

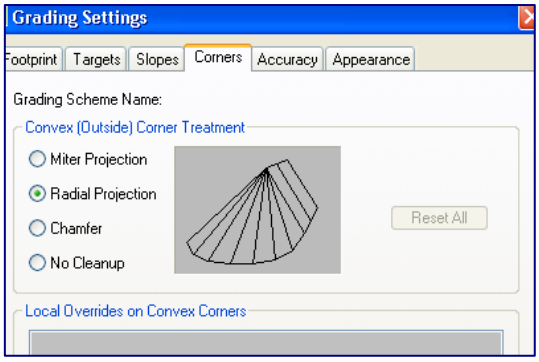
Go to **GRADING/SLOPE GRADING/ SETTINGS.**

There are a number of tabs associated with this dialogue box. The box opens up with the **Slopes** tab. This tab allows the user to set different values for both cut and fill. Ensure that slope is selected in both cut and fill and that the slope for the **Fill Slope** is set at 6.00. It is general practice that slopes away from the buildings be gradual to promote good runoff.



The **Targets** tab allows selection of the surface in which the object will project to. Ensure **Surface** is checked.

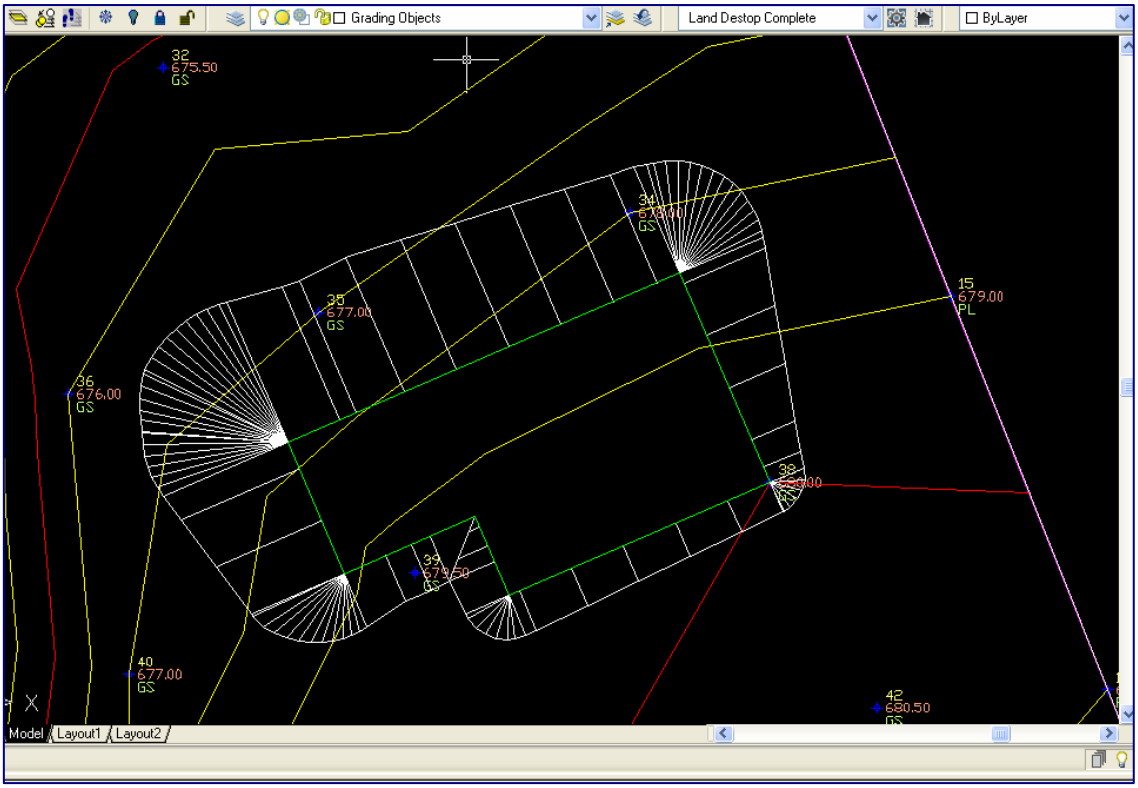
Under the **Corners** tab, check the **Radial Projection**. The other tabs allow further refinement of the grading object. The defaults will work for this exercise.



Click **OK** once all inputs have been made.

Note: The Grading Wizard, under **Grading/Slope Grading/Grading Wizard**, can also be used to handle more complicated footprints. See **Practice** pg. 17.

AutoCAD should display the following:



STEP TWO: INSERT GRADING OBJECT

First, make Grading Objects layer current. Under the **Grading** drop down menu, chose **Slope Grading/Apply Grading.** The command line will prompt for a selection of a polyline, line, arc, or grading object. Select the building footprint. Next, select a point on the outside of the footprint. Hit enter to select the default <N> or enter to **Keep old entity**. AutoCAD should display the following:

PRACTICE

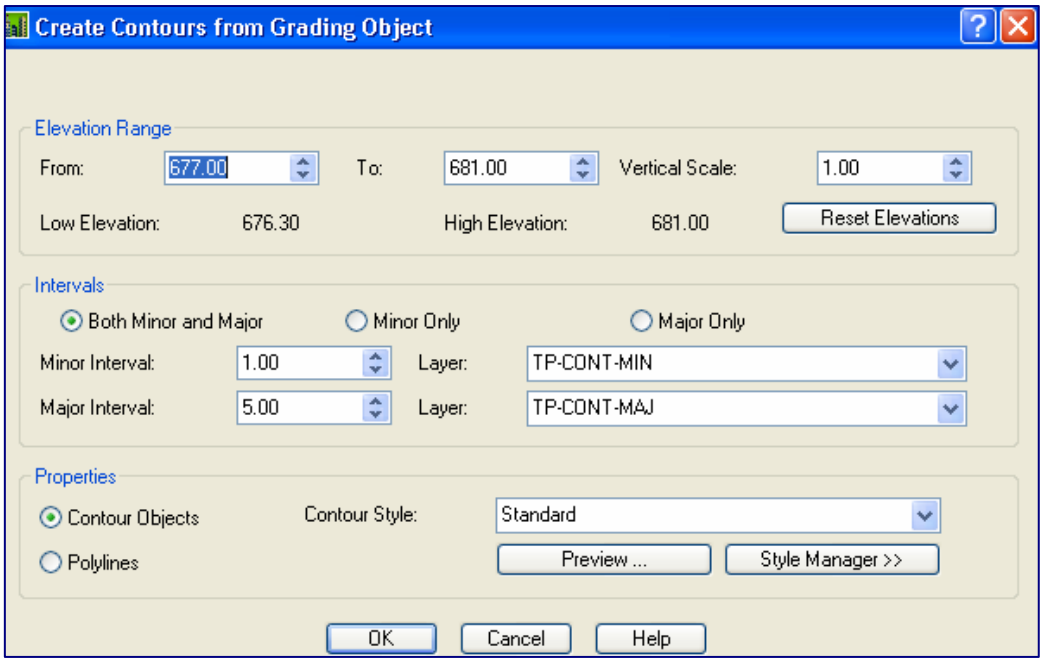
Grading Wizard: First, delete existing grading object. From the **Grading** dropdown menu, select **Slope Grading/Grading Wizard**. As before, select polyline and pick a point outside the footprint. The wizard will then prompt for a Grading Scheme Name and Description. Type in Rough Grading and Building footprint respectively. The footprint screen allows the user to add new vertices and/or change elevations (i.e. garage floor at a lower elevation). The next screen allows the user to add new regions. The slope screen is useful for vary the cut/fill slopes around the footprint. In this screen select add station. A new tag will be created at a default station of 38. Change the fill slope to 8. Select next to reach the corner screen. Change vertex 2 to convex miter. Select next to view Accuracy screen. Make no changes. The last screen allows the user to change the Appearance. Change fill projection color to Yellow. Select finish and hit return to accept the default <N> for erase old entity. Compare results with grading object shown above.

STEP THREE: EXAMINE RESULTS AND MODIFY

VOLUME OF MATERIAL: A lot of information can be gained from using grading objects. One of the more useful features is to determine the amount of cut/fill that is required during construction. To get this data, select **Slope Grading/Calculate Volume** from the **Grading** drop down menu. Select the grading object. The results should indicate that the Fill is equal to 376 cubic yards. As stated early, this information can not be taken as a concrete fact. Variances in the surface will occur. However, it can give the user an idea of the magnitude of fill that will be needed for the project.

FLOW LINES: One of the most useful items is to get a picture of how the flow will occur around the structure. In this case, the only key issue concerns the SW corner of the bldg. Provision must be made to smooth the flowline around the corner to prevent a problem from developing.

CONTOUR LINES: Although not necessary for this drawing, contour lines can be easily created from the grading object. Select **Slope Grading/Create Contours** from the **Grading** drop down menu. Selecting the grading object brings up a dialogue box allowing further customization. Click **OK** to accept the defaults. Hit enter to accept the default <Yes> to **Erase old contours**. Examine results.

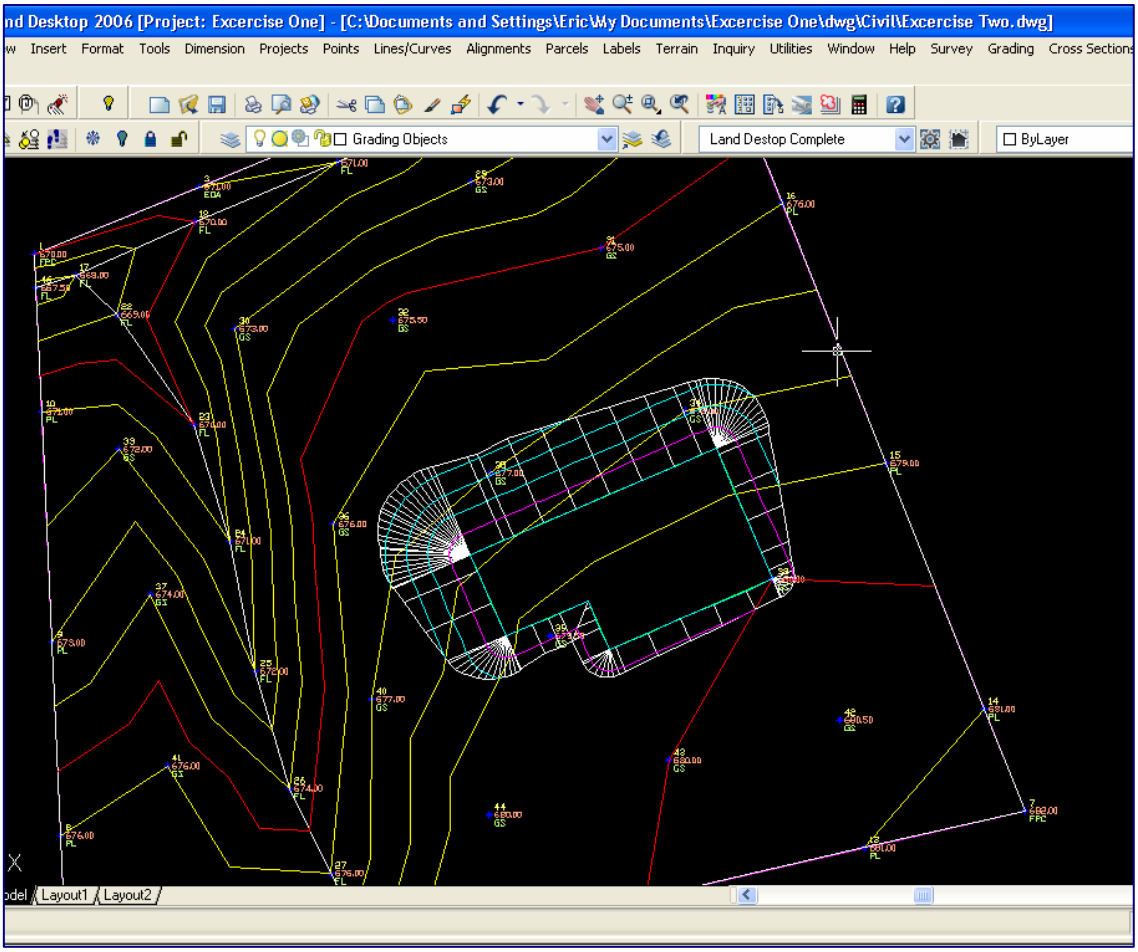


MODIFY: Select the grading object and right click the mouse. Choose **Grading Properties** from the list to bring back the Grading Properties dialogue box. This allows easy modification to the basic properties. More complex changes can be made by choosing to add vertices, regions or tags. These items were accessible through the Grading Wizard. See **PRACTICE** pg. 17 for more information.

Congratulations!! You have grading objects on Lot 1.

Before continuing, ensure your drawing matches the solution shown on the following page.

CAD Save: CE464/Lesson1/Exercise Two Solution-LAST NAME



END OF EXCERCISE TWO

Return to Page 6

UNTIED STATES AIR FORCE ACADEMY
CIVIL ENGINEERING 464
ARCHITECTURAL DESIGN

LESSON TWO

SITE DESIGN: ALIGNMENTS AND PROFILES

BACKGROUND:

Eagle River Water and Sanitation District (ERWSD) needs to complete a road project started in May 2005 (Phase I). The road is an access driveway to a proposed new waste water treatment plant. Because of funding, ERWSD only wants to continue the rough grade of the road from the point they left off in May 2005 (Phase II). A final finish grade will be completed with the construction of the plant scheduled for sometime in 2010 (Phase III). Peak Land Consultants (PLC) was the original contractor in 2005. Because of this previous work, they were sole sourced into completing the job. ERWSD has asked PLC to provide:

- Plan and Profile of new road
- Determine cut and fill requirements
- Develop an erosion control plan

Existing Site: The existing site has already been surveyed. There are a number of items that need to be addressed before the actual design of the road can begin. First,

CAD Open: CE464/Lesson2/Site

This drawing contains all the data for the project. The process is started by examining the existing topo combined with the road alignment designed during the Phase I.

CAD Type in **LMAN** on the command prompt. Select **Existing** and hit restore.

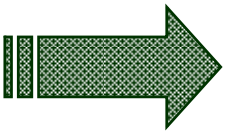
Take a few minutes to examine the site. Go to **VIEW/NAMED VIEWS/VIEW 1.** The alignment begins at the intersection of Hwy 6 at Station 1+00. As previously stated, this alignment was originally set in 2005. One of the first things to notice is that the road goes through the Denver Water Board property. Before any work began, ERWSD had to obtain an easement for their proposed access road. Zoom out and move to the east. The proposed road also crosses the Denver & Rio Grande Western Railroad. Again, an easement had to be obtained to cross their tracks. As part of the agreement, certain requirements for the road had to be adhered to in the design. One of these requirements was addressed during Phase I. The concrete rail crossing was installed per railroad specifications along the designed alignment. This crossing sets the tie in points during Phase II. Pan south from the crossing. The west side of the RR tracks is bordered by a sizeable cliff structure. Unfortunately, the topographical data does not continue the entire length of the western side. The need for this missing data will have to be overcome in the preparation of the hydraulic analysis.

Returning to the design process, one of the first steps is to create the most acceptable alignment. The things to consider in laying this alignment are:

- Minimize the grades of the proposed road (Large trucks will be servicing the waste water treated plant)
- Minimize the grade breaks in the road
- Cross the RR tracks as close to perpendicular as possible
- Minimize the easement requirement for the RR
- Minimize the cut and fill requirement (Ideally, no additional fill will be needed for the construction nor no additional cut will be created)
- Size the culverts on either side of the tracks to handle a 100 yr rainfall event

Returning to the drawing, select Named **View/Named Views/View 1** again. Notice the station mark 1 + 00. This indicates an alignment was created along the topo. Now select **View/Named Views/View 2**. This profile shows the alignment in relation to the existing surface. Profiles are usually created with the vertical scale being exaggerated to better show minor changes in grades. Notice at station 7+50, the alignment crosses the ditches and railroad tracks. In addition, at station 12+50, the alignment crosses a large rock outcropping. You can verify each of these features by checking the station number relative to the top on the plan view of the drawing.

This brings you to the first exercise. You will create an alignment for a residential site.



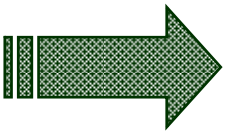
Go To Exercise One

Return to CE 464/Lesson 2/Site

Go to **View/Named Vies/View 3**. Before going any further in the design, a hydraulic study must be made to determine the proper size culverts to be installed on either side of the railroad tracks. The following steps were used:

- Determine the drainage basin that contributes to the overall flow.
    - One of the easy ways to get an overall picture of the drainage basin is to use the USGS topo maps. These maps are available for the entire country. They provide the engineer with an acceptable level of detail to determine approximate sizes of drainage areas.
- Conduct a site visit to identify features not displayed on the topo maps.
    - The site must be walked to find features such as culverts, flow lines, detention basins and other man made features that could affect the drainage. In this case several culverts under the highway were identified as well as several earthen berms that were created to redirect the flows coming down the hillside. These features were used to define the longest path a drop of rainfall would take to travel from the top of the basin to the culvert next to the railroad tracks (aka, time of concentration).
- Determine the method to be used to solve the drainage calculations.
    - There are several methods to solve this problem. The first method chosen in this case was the rational method. The solutions are shown in Appendix A. The flow of 65 CFS was higher then expected; therefore, HydroCAD was used to get a more precise number. HydroCAD uses the TR-20 method. The solutions are shown in Appendix B. As expected, this more precise method yielded a much lower flow number, 28 CFS.
- Once the flows were determined, the next step was to size the pipes.
    - The program FlowMaster was used. Two 18” concrete pipes were sized to handle the larger 28 CFS flow. Two smaller sized pipes were used Appendix C shows the results of FlowMaster for one of the pipes. One 18” pipe was sized for the other side of the tracks. Although it was oversized based on the very small flow, the ERWSD dictated that culverts be sized at lest 18” for ease of maintenance.

Now that the pipes are sized properly, the finished grade center line of the road can be designed. To better understand the process, you will first create a finished grade centerline for the residential site.



Go To Exercise Two

Type in **LMAN** on the command prompt. Select **1492-Plan and Profile** and hit restore.

Go to **View/Named Views/View 4**. The finished road grade has now been added to the profile. As required, the grade breaks were minimized using vertical curves. The crossing at the tracks was kept as close to zero grade as possible. The culverts were inserted to address the issue of minimum cover over the pipe. Because of the 18" cover requirement, the pipes were changed from round to elliptical. In addition, the two pipes were moved further away from the tracks in order to handle the flows from both the ditch next to the railroad and the ditch created by the earthen berm just west of the tracks (You can see the flowline by following the "V"s in the contours).

Before going any farther, it's important to look at how the final product will be presented. Click on the **C1.0 Driveway Plan and Profile** tab. Notice how the drawing has been rotated. This requires less sheets and the ability for the display to present the plan and profile together on one page. Another important note is in regards to Text. If you don't rotate the drawing before you begin, the text will have to be rotated in the final presentation (This requires a lot more work). So, return to **Model** space. Zoom and pan to the railroad crossing. On the command prompt, type **DVIEW**. Type in **ALL** and hit **Enter** when prompted for select objects. Hit **Enter** again. Now, type in **TW** for Twist. For this drawing the view twist angle is **45** degrees. Hit **Enter** again to exit the command. If the road alignment were to have several more curves and direction changes, you might have to twist the drawings several times in order to present a plan and profile view.

Spend some time reviewing the drawing. The information provided is typical of what is necessary for the road to be built. In addition, you can change the alignment to see individual cross sections on the road and two ditches.

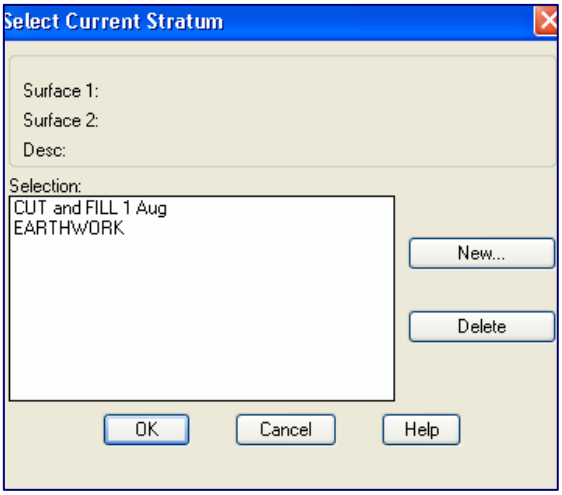
The first requirement for a plan and profile has been completed. The remaining items left are the cut and fill requirements and the erosion control plan.

Type in **LMAN** on the command prompt. Select **1492-GRADING AND DRAINAGE** and hit restore.

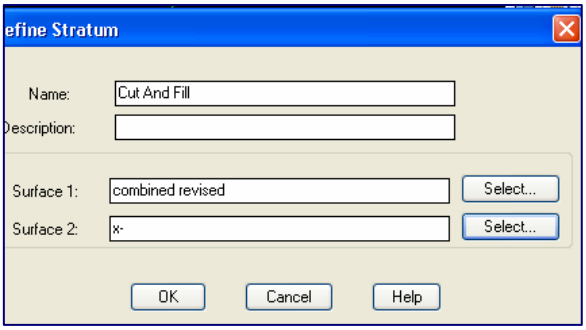
Go to **View/Named Views/View 5**. AutoCAD performed a calculation of the amount of cut and fill based on the differences between the surfaces created for the road and ditches versus the existing ground. For this project, an additional 415 CY of cut is created. This number should be used with caution. As with other results, the existing topo is not 100% accurate. However, it can be used to help plan out the project. In this case, the project manager can expect to have excess cut to either haul away or store on site.

The procedure used to arrive at this number is as follows:

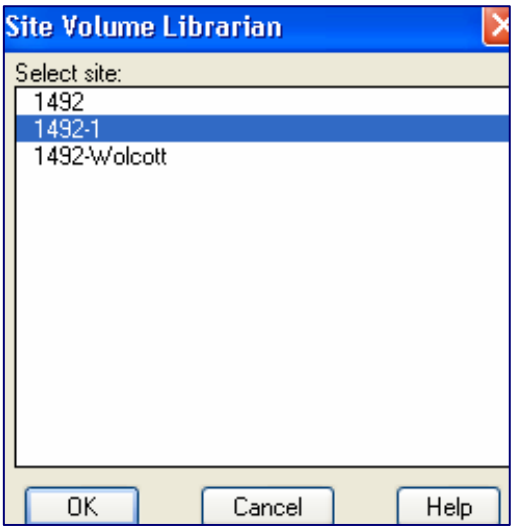
STEP ONE: DEFINE SURFACES



Go to **Terrain/Grid Volumes/Calculate Total Site Volume**. AutoCAD should display the following dialog box. The two previous stratums used should be displayed. To create a new stratum, select **New**.



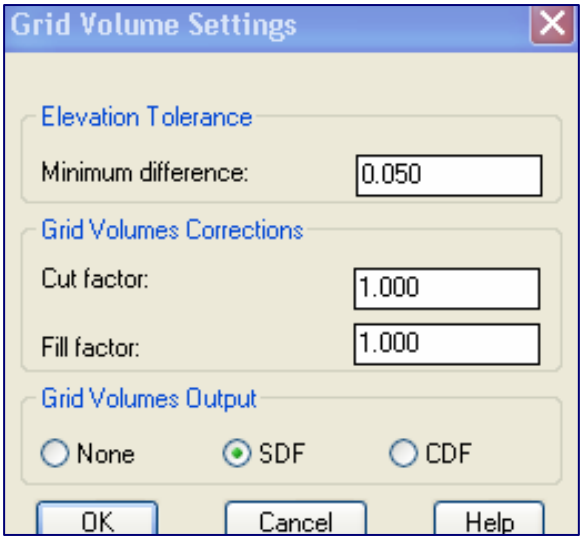
Enter **Cut and Fill** for the **Name** of the new Stratum. Select **Surface 1** and **Surface 2** by using the **Select** button. The two surfaces chosen are for the road and ditches versus the existing topo. Click **OK**.



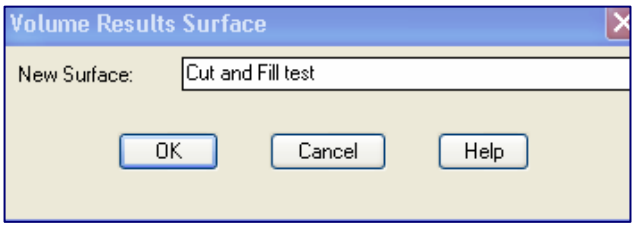
AutoCAD will then prompt for a site with the Site Volume Librarian dialog box. Chose a site from the list. Click **OK**.

STEP TWO: SET TOLERANCES

AutoCAD will continue the site volume command by prompting you to set the **Grid Volume Settings**. This is the most important step. You should try several iterations to reach an acceptable result based on the level of detail in your topo. One caution, this command takes a great deal of memory. Setting the tolerance to low will likely result in a crash of the program. For this example, set the difference to **0.050** and the Cut and Fill Factors to **1.0**. Click **OK**.



Enter **Cut and Fill test** for **New Surface** name.
Click **OK**.



STEP THREE: EXMAINE RESULTS

As stated previously, AutoCAD takes several minutes to reach this step. AutoCAD should display the following results:

From the CAD information, the project site will likely result in excess cut. This information was passed on to ERWSD. The district decided to store the excess material on the future site of the waste water treatment plant.

The last item remaining is to develop an erosion control plan. The intent of this plan is to ensure the site does not affect the adjacent land or water. This can be a very difficult process if the area involves any wetlands or sensitive habitat.

CAD

Type in **LMAN** on the command prompt. Select **1492-EROSION** and hit restore.

Take some time to pan around the drawing and read the erosion control notes. The notes are fairly typical of any county's requirements. Differences will result from variances in climate and topography. Silt fences and straw bales are also common measures to control runoff from a site. Silt fences are cheap but can be labor intensive to install. Waddles are a bit more expensive but take less time to install. It is often up to the county to decide and approve any erosion plan. The county also has the responsibility to ensure the contractor is meeting the requirements unless the project management has also been outsourced.

Access Driveway: The process used to complete this design can be used for any type of surface. Runways, taxiways, roads, etc can all be designed following these steps. AutoCAD allows the engineer to provide a quality product that can be easily modified. In regards to the actual project, ERWSD completed the driveway during Feb 2007.

END OF LESSON TWO

CAD

EXERCISE ONE: Create Alignment & Profile

Open: CE464/Lesson2/Exercise One

The drawing should look familiar. It is the site built during Lesson One. At this point, the assumption is that the house as well as the grading around the house is close to being finished. Go to **Terrain/Set Current Surface**. You will notice that there is only one surface available. The existing surface and the house grading surface have been combined. The **house grading** surface was created from the grading object created in Lesson One. The **Combined Surface** was then constructed by using the Existing and house grading 3D lines to build a new surface. The site is now ready for creating a new alignment.

Select **Combined Surface** and click **OK**.

The only other difference is the addition of a polyline connecting the house (center of garage) perpendicular to the road. You will use this polyline to create the alignment.

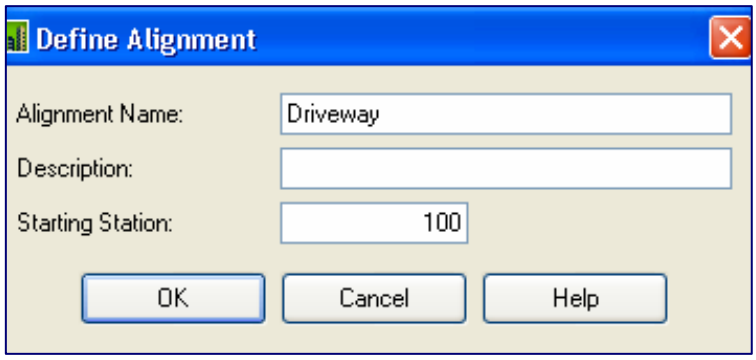
Type **LMAN**. Select **Save** and type in **Preliminary Design**.

STEP ONE: DEFINE ALIGNMENT

From the Alignment drop down menu select **Alignments/Define from Polyline.** Select the newly created polyline when prompted. Hit enter to accept the default for Select reference point. The red "X" indicates that the alignment will begin at the road.

Note: The alignment direction when using **Define from Polyline** matches the direction used in creating the polyline.

The following prompt will be displayed:

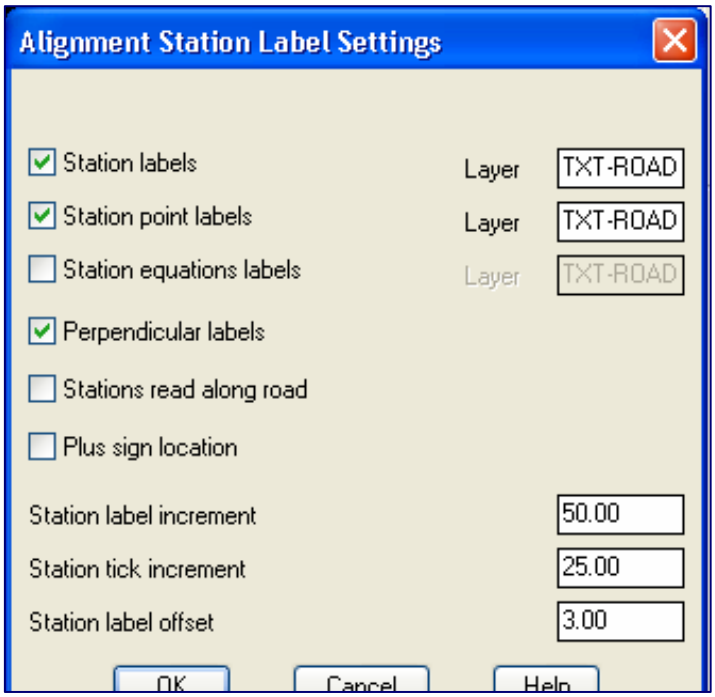


For Alignment name, enter “Driveway”. For Starting Station, enter ‘100”

The program will then calculate the alignment. Once the process is complete the command prompt will return.

STEP TWO: ADD STATION LABELS

The next step is to create station labels. Under the Alignment dropdown menu select **Alignments/Station Label Settings**.



Ensure that Station labels, Station point labels, and perpendicular labels are selected.

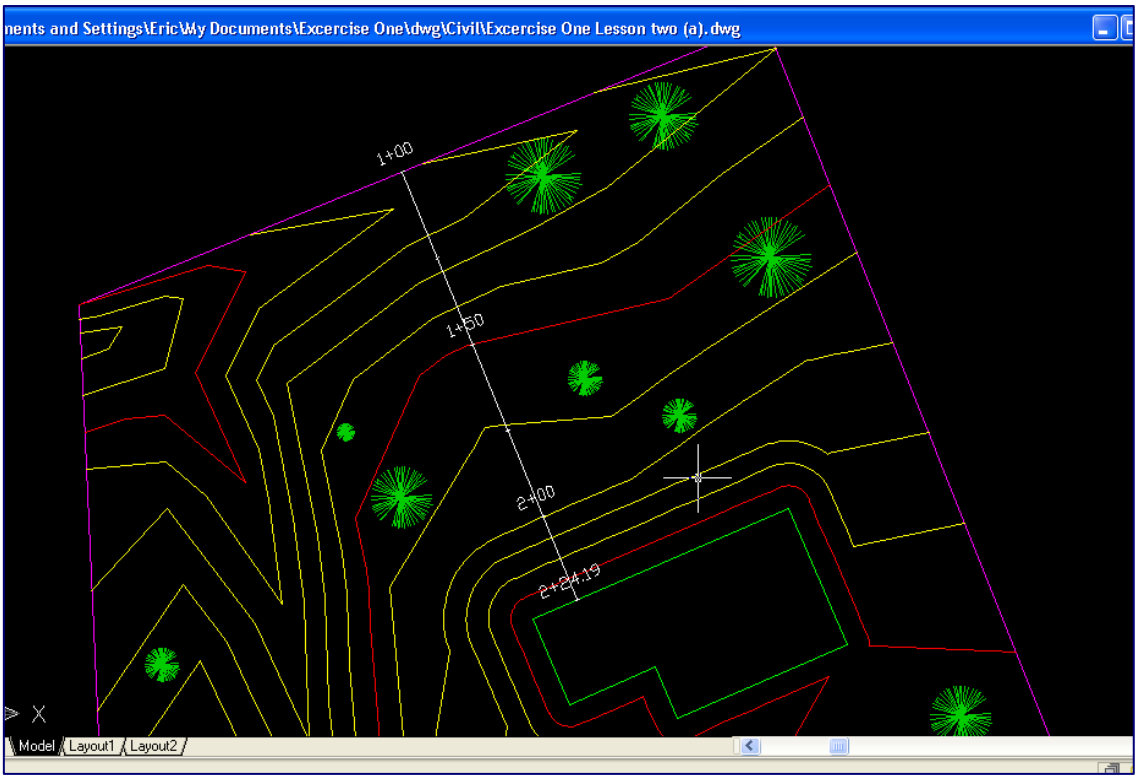
Set Station label increment to 50, station tick increment to 25 and Station label offset to 3.

Click **OK**.

Under the Alignment dropdown menu select **Alignments/Create Station Labels.**

Hit enter to accept the default of <100.00> for Beginning station. Hit enter to accept the

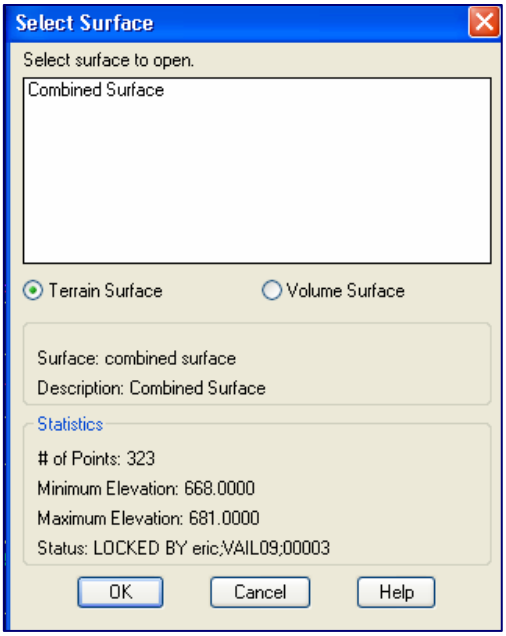
default of <224.19> for Ending station. Hit enter to accept <Yes> for Delete existing stationing layers. AutoCAD should display the following:



Note: For display purposes, the height of the alignment text has been increased to 3.0 from 1.0.

STEP THREE: CREATE PROFILE

Under the Profile drop down menu, select **Profiles/Surfaces/Set Current Surface**. This step becomes very important when you have a larger drawing with multiple surfaces. The sample driveway project will illustrate this point.



Click on **Combined Surface** under Select surface to open.

Click **OK** to accept.

Under the Profile drop down menu, select **Profiles/Existing Ground/Sample from Surface.**

Click **OK** to accept the defaults under the Profile Sampling Settings dialogue box.

Hit enter to accept the default <100.00> for **Beginning station**. Hit enter to accept the default of <224.19> for **Ending station**. AutoCAD should indicate that you have sampled profile for 124.19 feet of alignment.

On the command prompt, type in **INSUNITS** and type "**0**" when prompted.

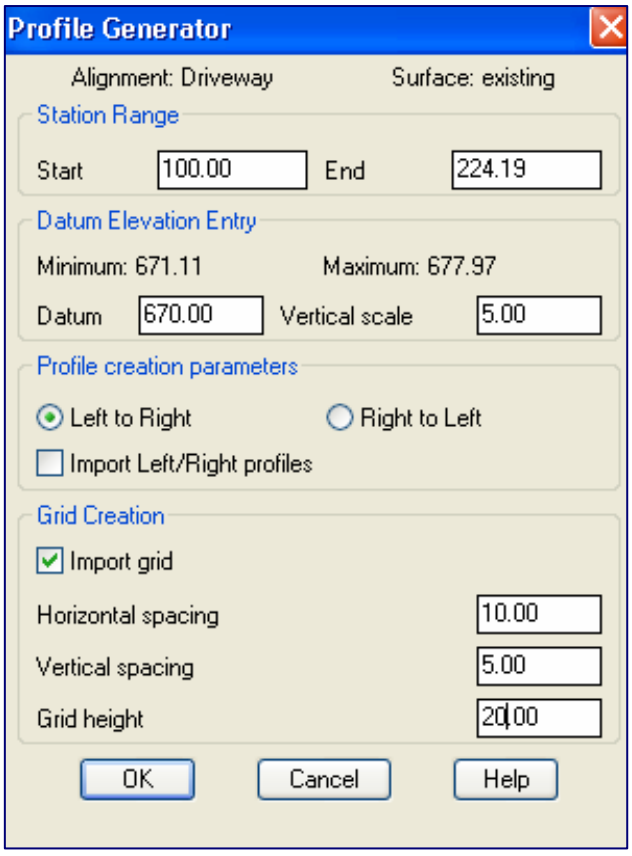
Now you are ready to create the profile. Under the Profile drop down menu, select **Profiles/Create Profile/Full profile.**

Ensure the Datum is set to 670.00, the Vertical scale is at 5.00, and the import grid box is checked with the Horizontal spacing set to 10.00, the Vertical spacing set to 5.00 and the Grid Height is 20.00.

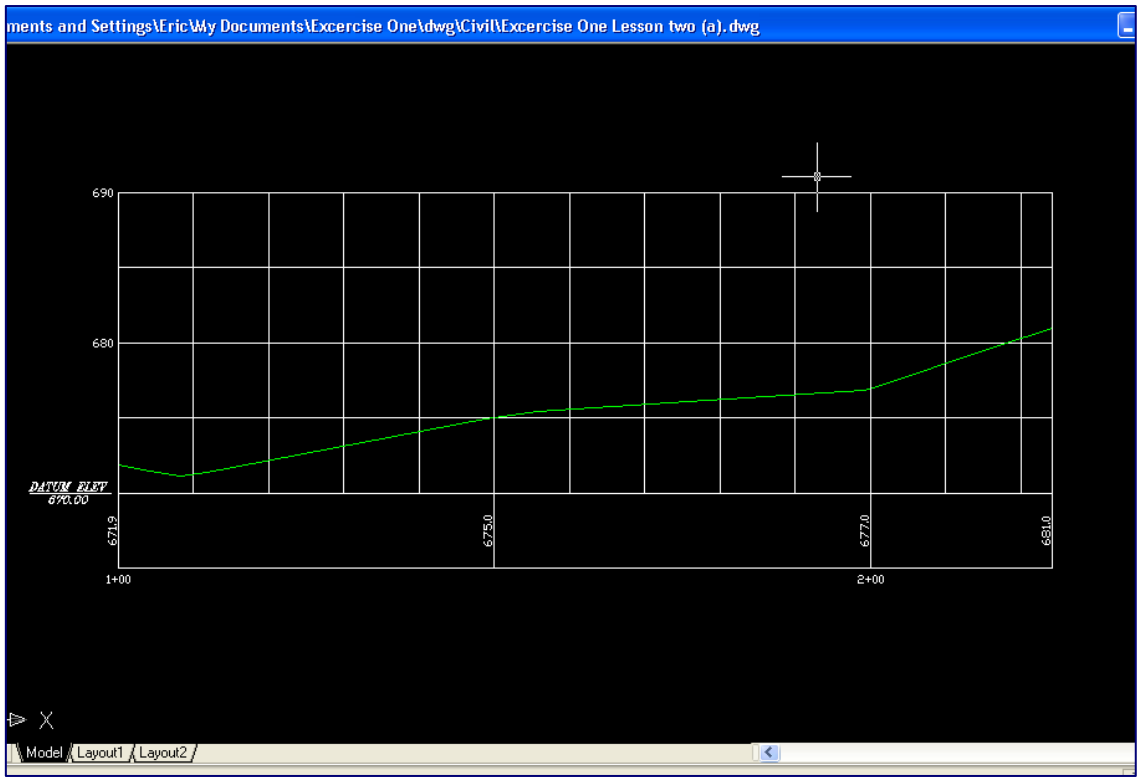
Click **OK**.

AutoCAD will then prompt you for a starting point. Using the cursor select a point to the right of the drawing.

Hit enter to accept the default <Yes> to delete existing profile layers.



AutoCAD should display the following:



If you select the line inside the profile, you will see that it is a polyline created on the DRIVEWAYPEGC layer (The line color was changed to green for contrast). This line represents where the existing ground and the driveway alignment intersects. You should also notice that the vertical scale of the drawing is exaggerated. If you check the length of a line between the 680 to 690 grid lines, you will see that the vertical scale is 2:1. This scale should match the same 2:1 scale for your Drawing Setup.

Save the drawing as **Exercise 1 Lesson Two-Last Name.**

END OF EXCERCISE ONE

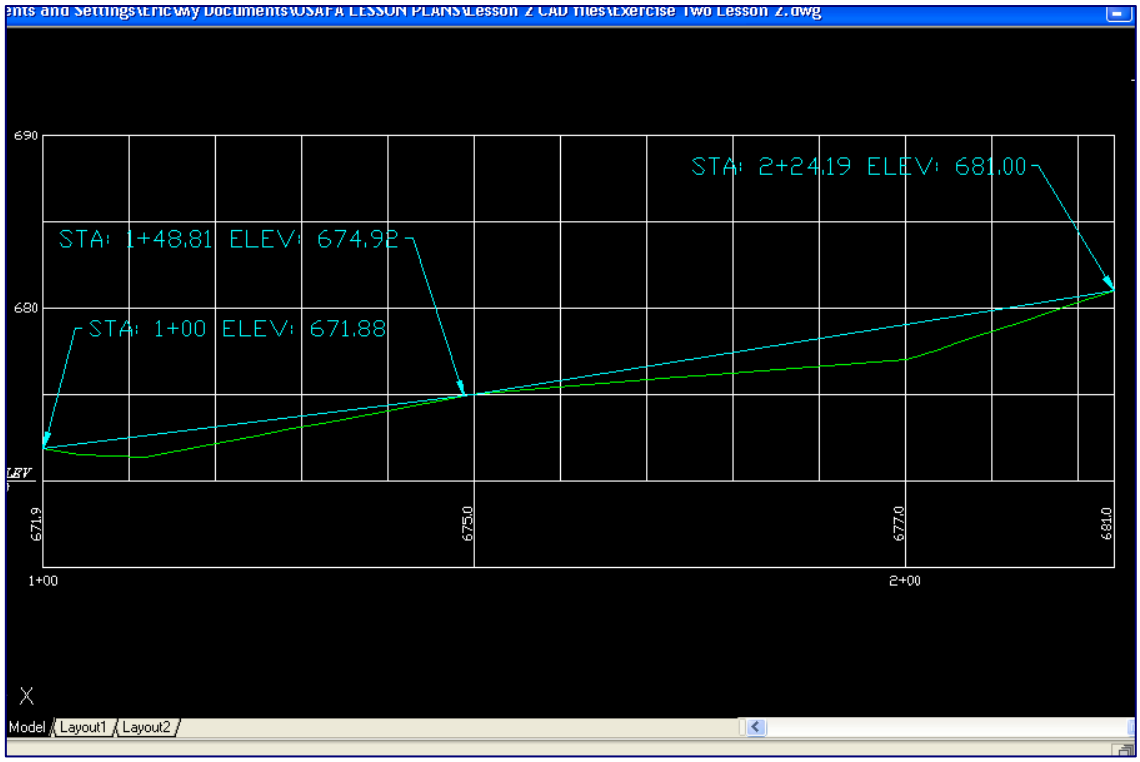
Return to Page 3

CAD **EXERCISE TWO**: Create Finish Grade CL

CAD Open: CE464/Lesson2/Exercise two Lesson 2

STEP ONE: CREATE TEMPORARY FINISH GRADE CENTERLINE

Go to **View/Named Views/View 2**. Set **0-const 2** layer current. Using a polyline, create a line from Sta 1+00 Elev. 671.88 to Sta. 1+48.81 Elev. 674.92 and ending at Sta. 2+24.19 Elev. 681. Note: The second point of this polyline can easily be created by ensuring the snap endpoint is turned on. With the exception of the text and leaders, AutoCAD should display the following:



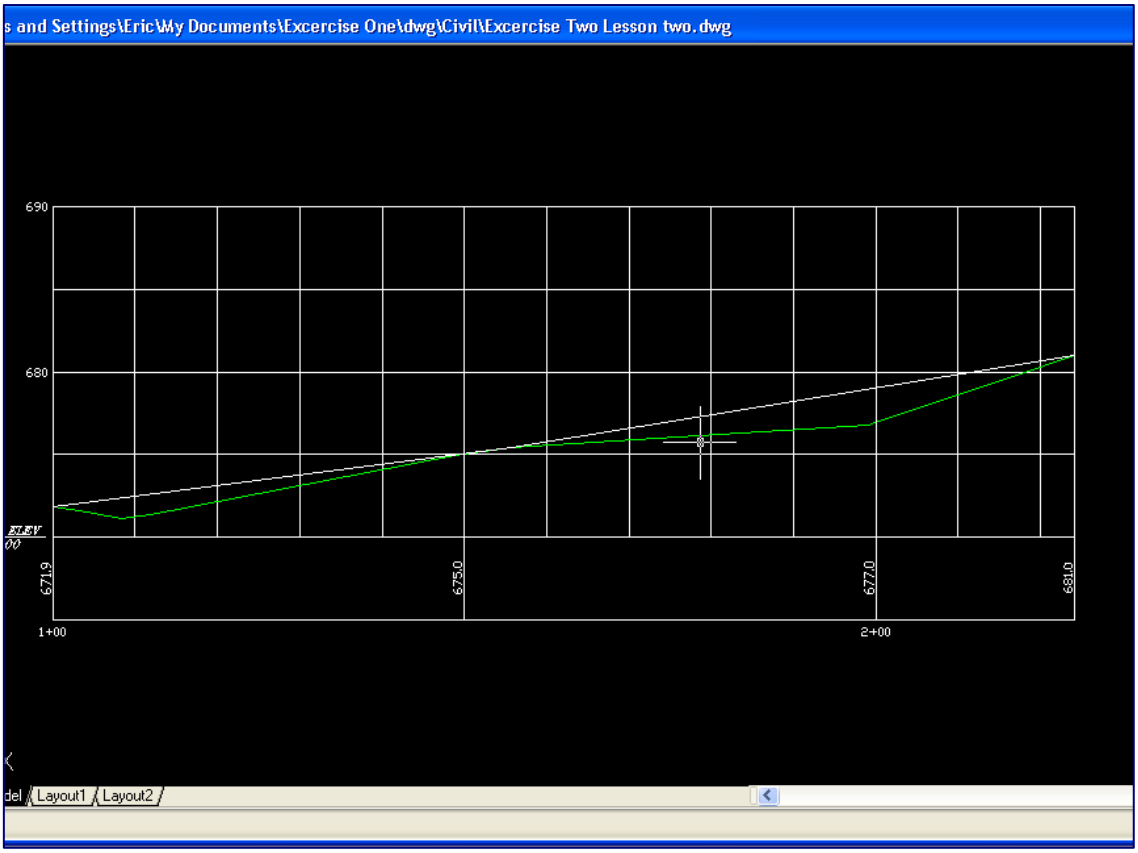
Note: The text was created by selecting **Profiles/Label/Spot Elevations**.

The point of using a temporary polyline is to allow a bit of flexibility in determining a finished grade. Simple applications such as this driveway do not require this step. However, it can be useful to save draft profiles for comparison.

STEP TWO: CREATE CENERLINE TANGENT

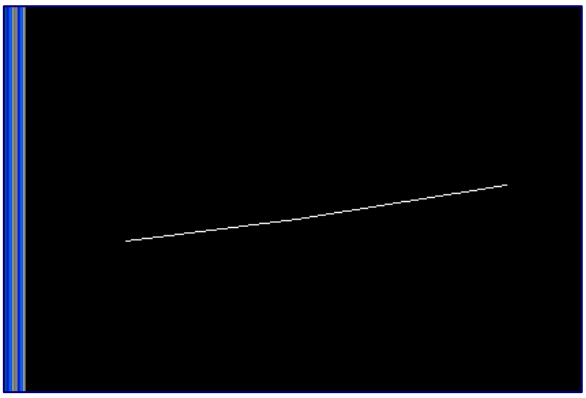
Go to **Profiles/FG Centerline Tangents/Create Tangents**.

Ensure the endpoint snap is on and select the endpoint of the temporary CL polyline at Sta. 1+00. Hit enter to accept the default <100.00>. Hit enter to accept the default elevation of <671.88>.
Move up the polyline to select the endpoint at Sta. 1+55.70. The Sta. and Elev. are entered automatically. Finish the command by selecting the endpoint of the polyline. The newly created line should be created on the DRIVEWAYPFGC layer. Freeze the 0-const2 layer. AutoCAD should display the following:

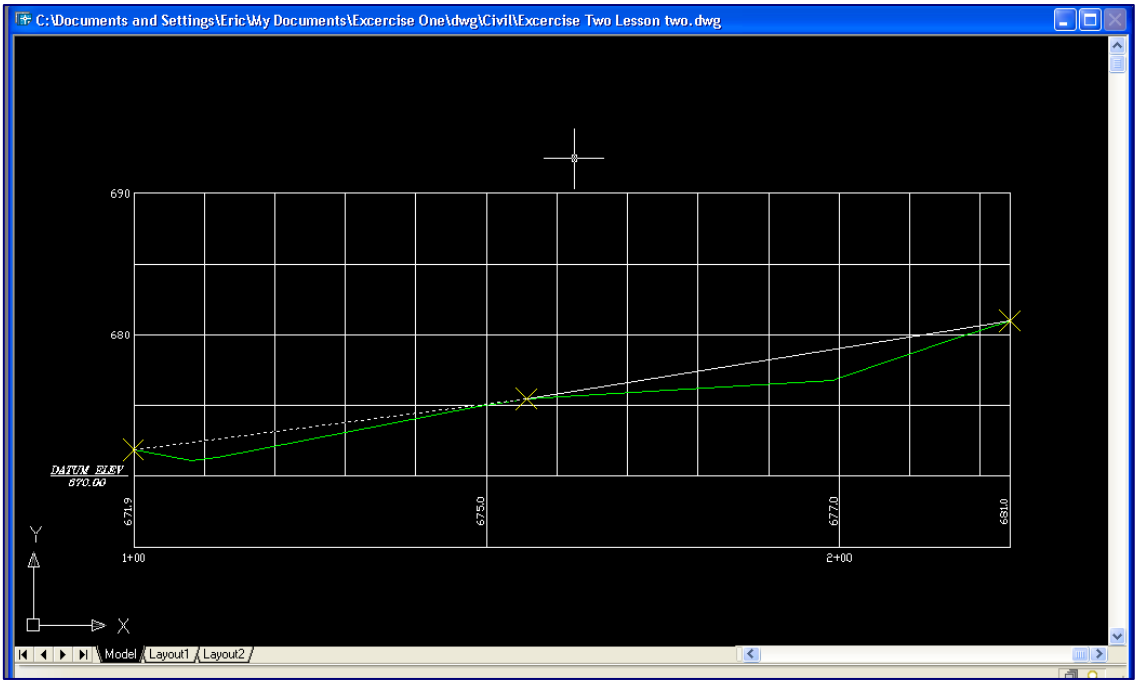


STEP THREE: DEFINE FG CENTERLINE

Go to **Profiles/FG Vertical Alignments/Define FG Centerline**.



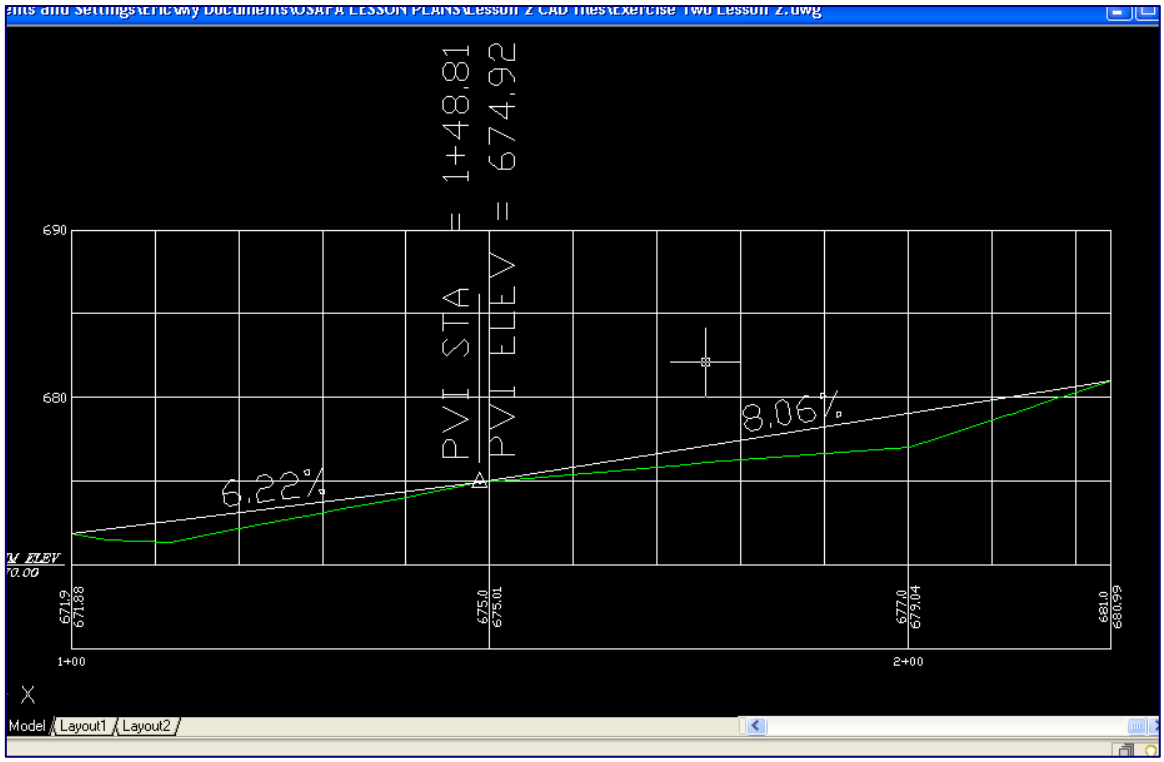
AutoCAD recognizes the tangent created previously in Step Two. Select the left end of the line when prompted to **Select the starting point**. A yellow X will be placed on the endpoint. Select the rest of the line when prompted to **Select objects**. AutoCAD will then redraw the profile with the FG Centerline defined. The command line should indicate that 3 CL PVIs were created. AutoCAD should display the following:



STEP FOUR: IMPORT FG CENTERLINE

Go to **Profiles/FG Vertical Alignments/Import**

This step will import and label the FG centerline. Hit enter to accept the default <Yes> for Label tangents and vertical curves. Hit enter to accept the default <Yes> for Delete finished ground profile layer.

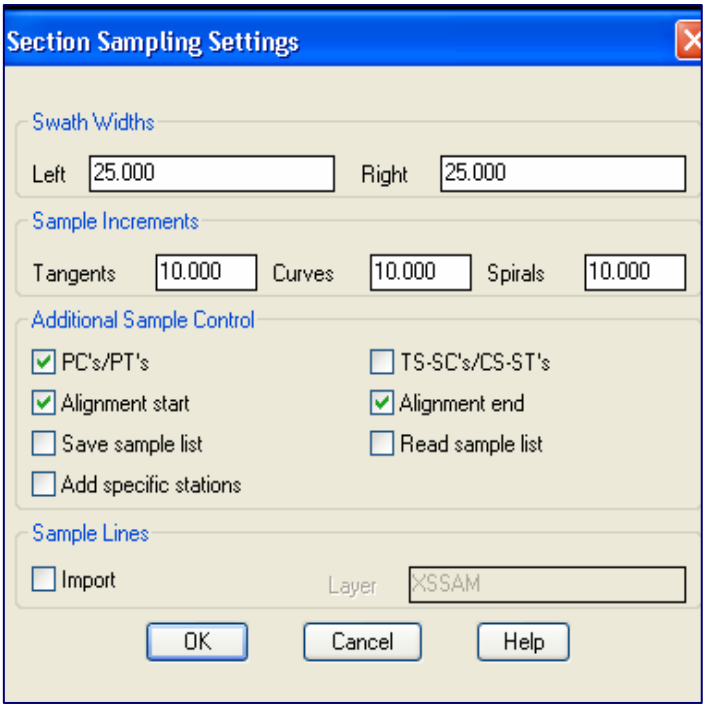


Note: For display purposes, the height of the alignment text has been increased to 3.0 from 1.0.

STEP FIVE: SAMPLE SURFACE

Go to **Cross Sections/Surfaces/Set Current Surface.** Select Combined surface

Go to **Cross Sections/Existing Ground/Sample from Surface.** Select Combined surface



Ensure the following setup:

Left and Right Swath widths set at 25. (The distance to sample from the centerline)

Tangents, curves, and spirals set to 10.00.

Check PC's/PT's, Alignment start and Alignment End

Click **OK**

Hit enter to accept the default start of <100>. Hit enter to accept the default end of <224.19>.

Hit enter when asked about critical station. Note: This allows you to insert another point along the alignment where you might need to see a cross section to determine if conflicts exist.

Enter "Yes" to overwrite existing data

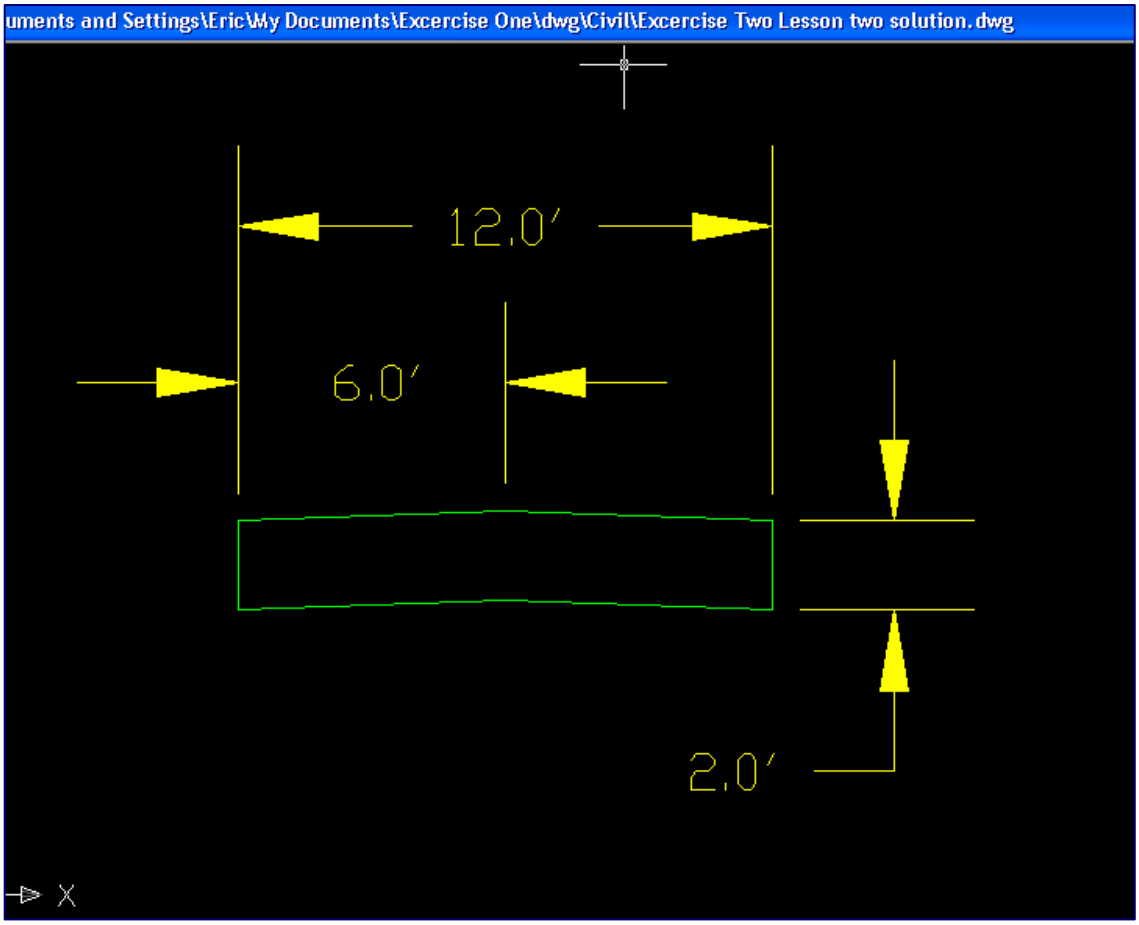
The command prompt should indicate that you have sampled 124.19 feet of alignment.

STEP SIX: DEFINE TEMPLATE FOR DRIVEWAY

Go to **Cross Sections/Draw Template**

When asked for a starting point, select a point below the profile.

Type in “G” for Grade when prompted to Select point. Type in “2” for 2 percent for Grad (%). Type in “6” for 6’ for change in offset. Type in “-2” for negative 2 percent for Grade (%).Type in “6” for 6’ for change in offset. Now type in “R” for relative. Type in “0” for change in offset. Type in “-1” for change in elev. Type in “G” for grade. Type in “2” for 2 percent for Grad (%). Type in “-6” for negative 6’ for change in offset. Type in “-2” for negative 2 percent for Grade (%).Type in “-6” for negative 6’ for change in offset. Now type in “R” for relative. Type in “0” for change in offset. Type in “1” for change in elev. Type in “X” to exit. Hit enter to return to the command prompt. AutoCAD should display the following:



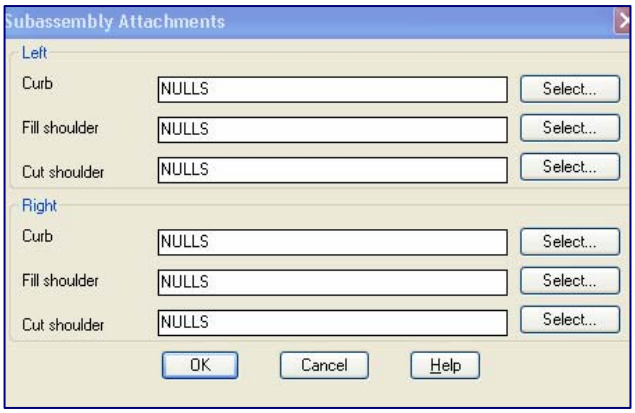
Note: For display purposes, dimensions were added to indicate final product. Also notice that the vertical dimension indicates AutoCAD automatically adjusted the vertical scale at 2:1. This template represents a typical driveway cross-section. The driveway is

sloped form the centerline at 2%. The 1' foot depth allows for a composite of compacted subgrade, compacted grade, and asphalt/concrete. The actual depths of each material will be decided by the local conditions and owner desires.

Go to **Cross Sections/Templates/DefineTemplate**

When prompted to Pick finish ground reference point, select the top centerline. Hit enter to accept the default <Yes> for **Is template symmetrical**. Select the driveway cross-section when asked to select objects. Hit enter. Hit enter to accept the default <Normal> For **Surface type**. Type in "Composite" for Material name. Pick the upper left corner for Pick connection point out. Hit enter to accept the default <1> for Datum number. Starting with the upper left hand corner pick points in a counter clockwise pattern to include; lower left-hand corner, lower centerline point, lower right-hand corner, and finally upper right-hand corner. Do not include the upper centerline point. Hit enter.

AutoCAD should then display a Subassembly Attachment dialogue box. Click **OK** to accept the defaults (No attachments are necessary). Hit enter to accept the default <Yes> to Save template. Type in "Driveway" for **Template name**. Type in "N" when prompted to **Define another template**.



Go to **Cross Sections/Templates/Edit Template**

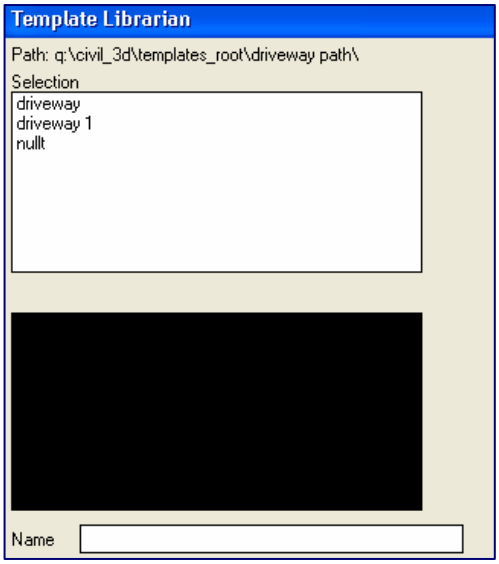
Select Driveway from the Template Librarian. Click **OK**.

Pick a point above the template drawn earlier when prompted to Pick insertion point.

Type in "SR" to construct the surface.

Type in "T" to build the top surface.

Hit enter to accept the default <1> for Top surface number.



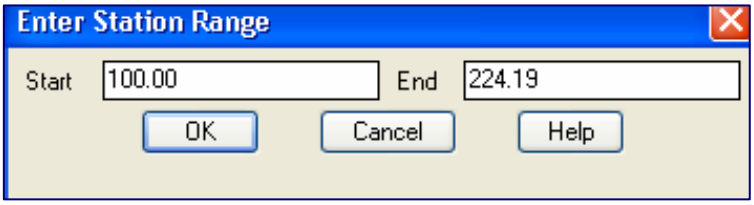
Starting from the upper left-hand corner pick points the three upper points; upper left-hand corner, upper centerline point, and upper right-hand corner. Hit enter to exit. Type in "X" to exit the command.

Hit enter to accept default <Yes> to Save template. Hit enter to accept the default <driveway > for Template name. Hit enter to accept the default <yes> to Overwrite template.

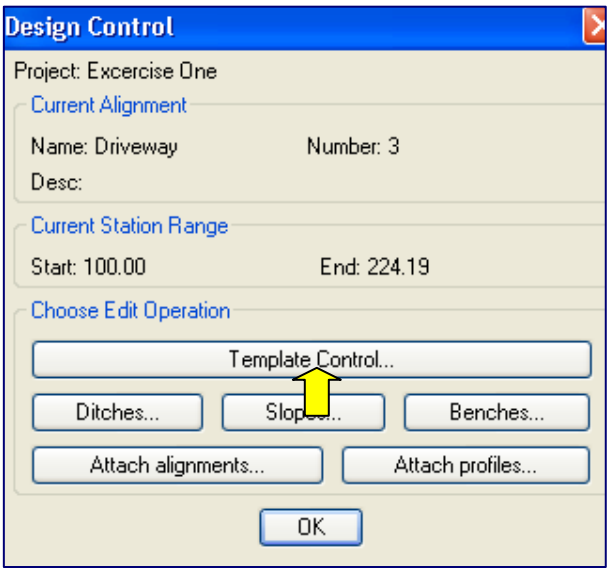
You should end up with an exact copy of the template you drew earlier.

STEP SEVEN: RUN TEMPLATE ON EXISTING DRIVEWAY

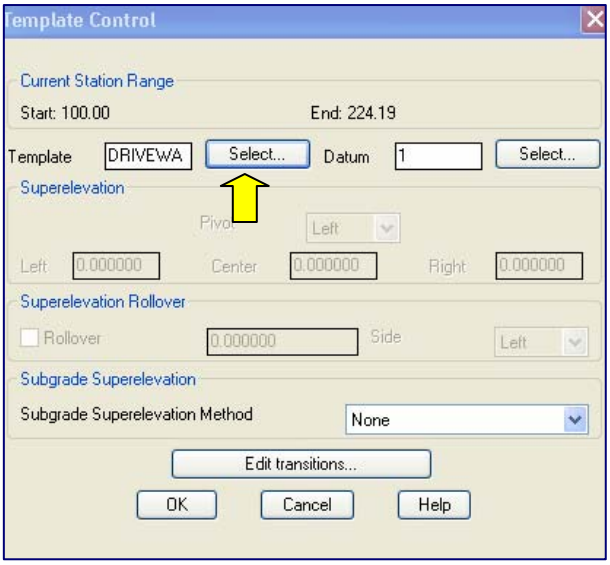
Go to **Cross Sections/Design Control/Edit Design Control**



Click **OK** to accept defaults for Enter Station Range.

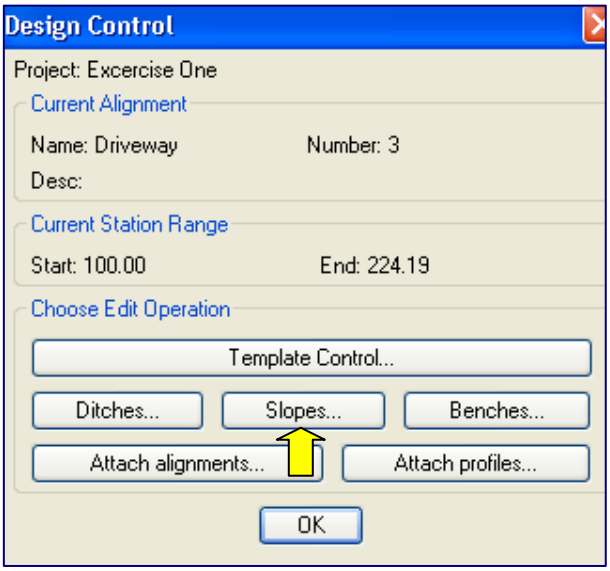


Select **Template Control** in the Design Control dialog box



Select the **Select** button next to Template. Choose driveway from the Template Librarian and select **OK**.

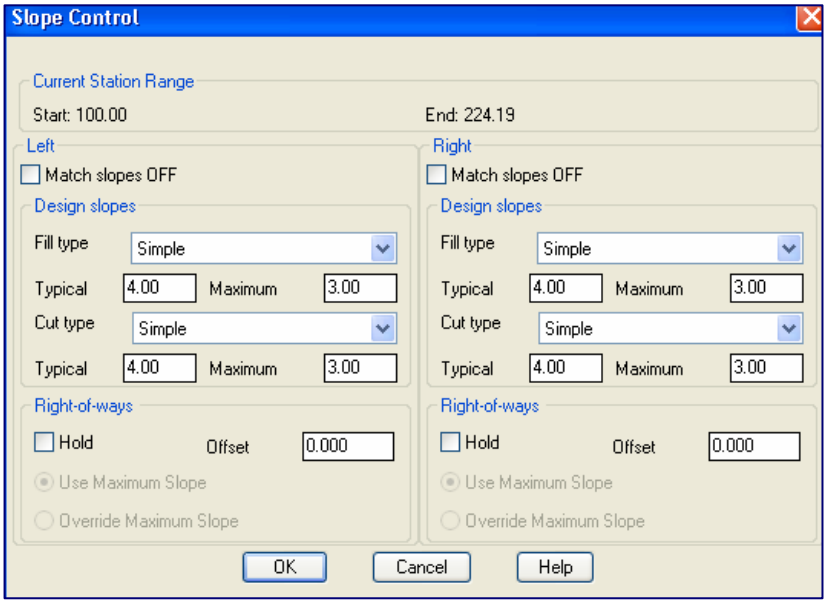
Click **OK** to return to the Design Control dialog box.



Select Slopes from the Design Control dialog box.

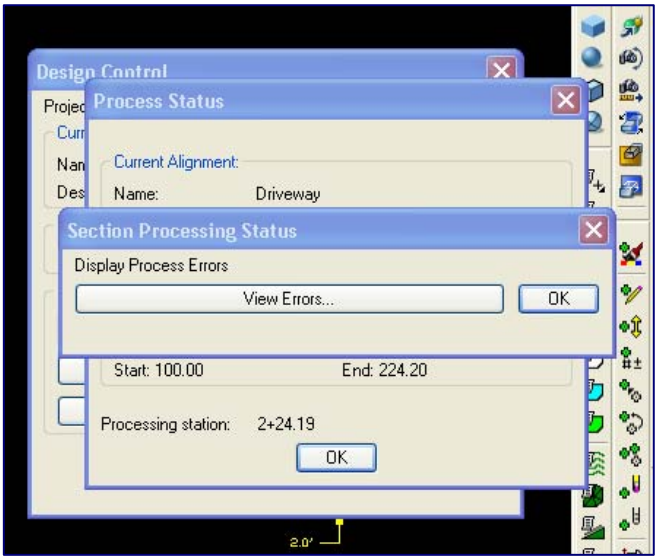
Ensure the following:

Under both Left and Right, the typical Fill and Cut type should be simple and the parameter for typical set to **4.00** and the parameters for maximum set to **3.00**.



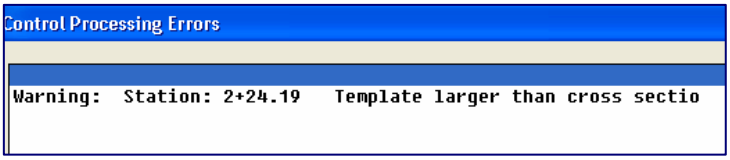
Click **OK**

Click **OK** when AutoCAD returns to the Design Control dialog box.



You should get the following dialog box.

Select View Errors.



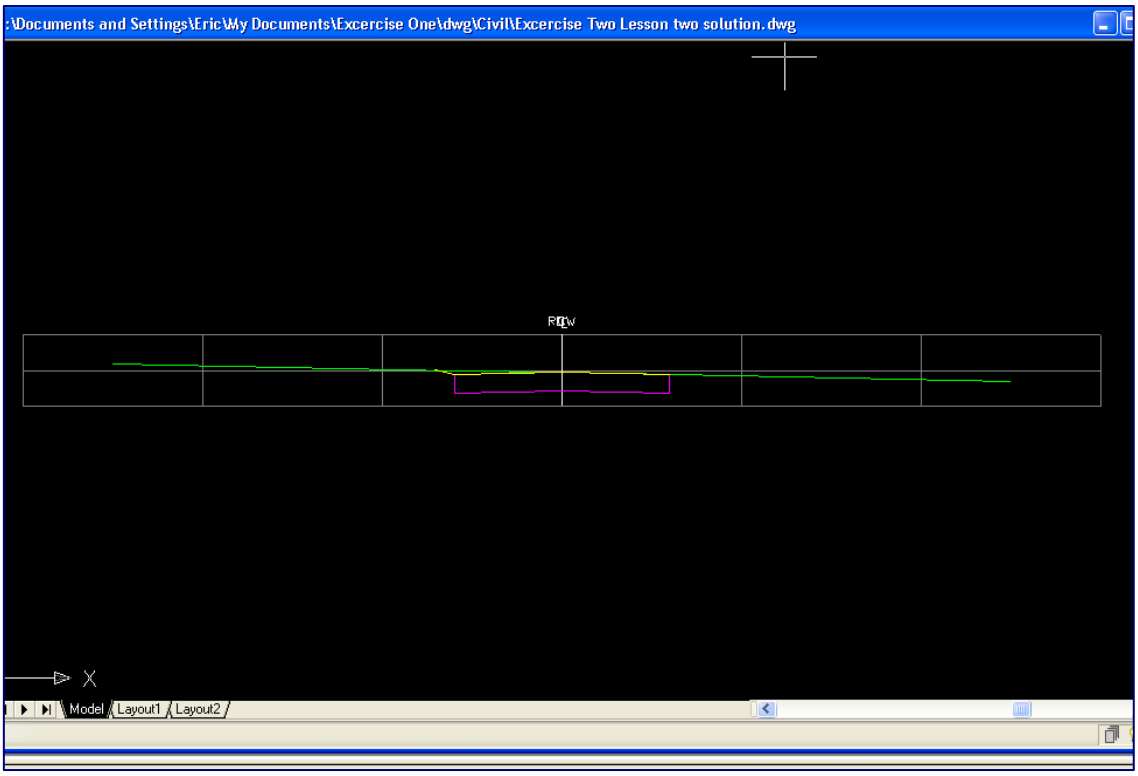
The only error that should be displayed involves the end of the alignment. That should not create any problems. Click **OK**.

Click **OK** to exit the Section Processing Status dialog box.

STEP EIGHT: VIEW SECTIONS

This step allows you to check the cross-sections for obvious errors.

Go to **Cross Sections/View/Edit Sections**.

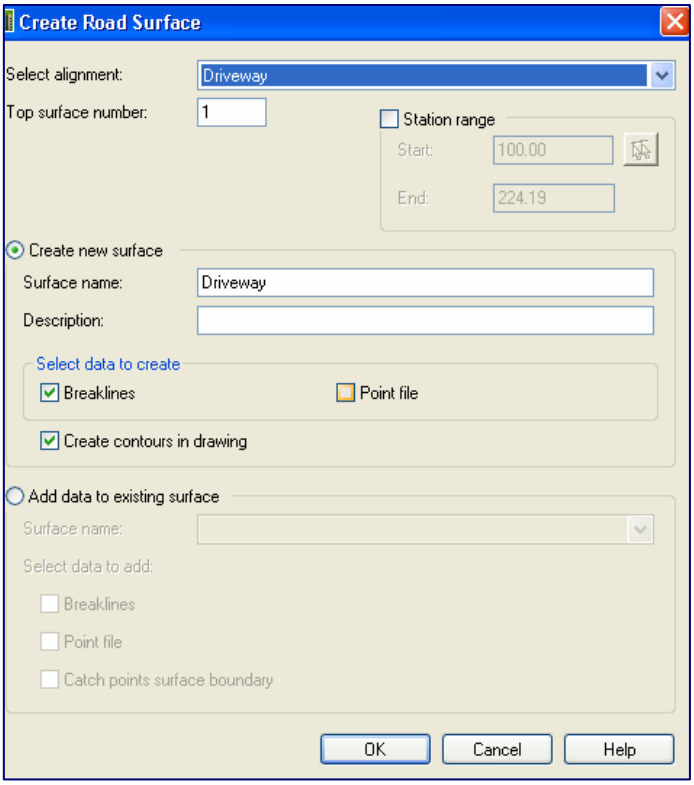


Hit enter to accept the default <Next> to view sections in 10' increments.

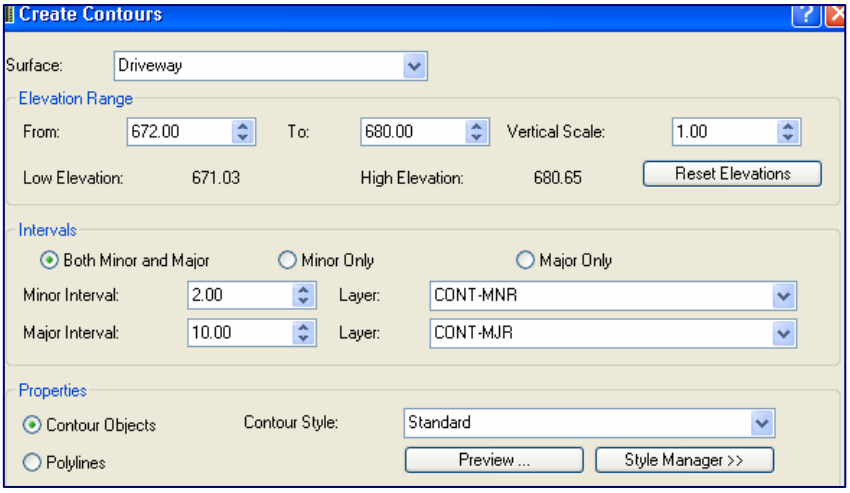
Note: One of the main principles behind creating sections is the ability to spot any problems or conflicts before proceeding any further in the design process. Main utility easements, ties into existing surfaces, etc can be easily seen with a section view.

STEP NINE: CREATE ROAD SURFACE

At this point, the road surface is ready to be placed onto the Combined Surface. Go to **Cross Sections/Road Output/Create Road Surface**.



The Create Road Surface dialog box should be displayed. Click **OK** to accept all of the defaults.

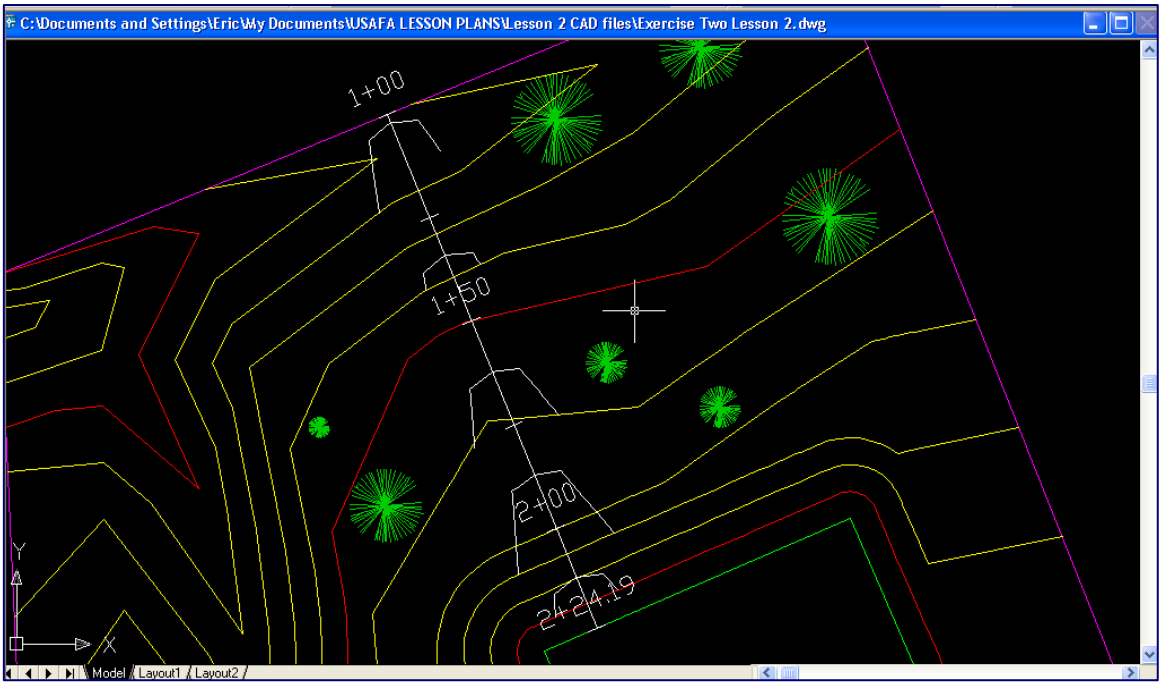


After performing the required calculations, AutoCAD should display the Create Contours dialog box.

Ensure the **Both Minor and Major** box under **Intervals** is checked and Click **OK** to accept all rest of the defaults.

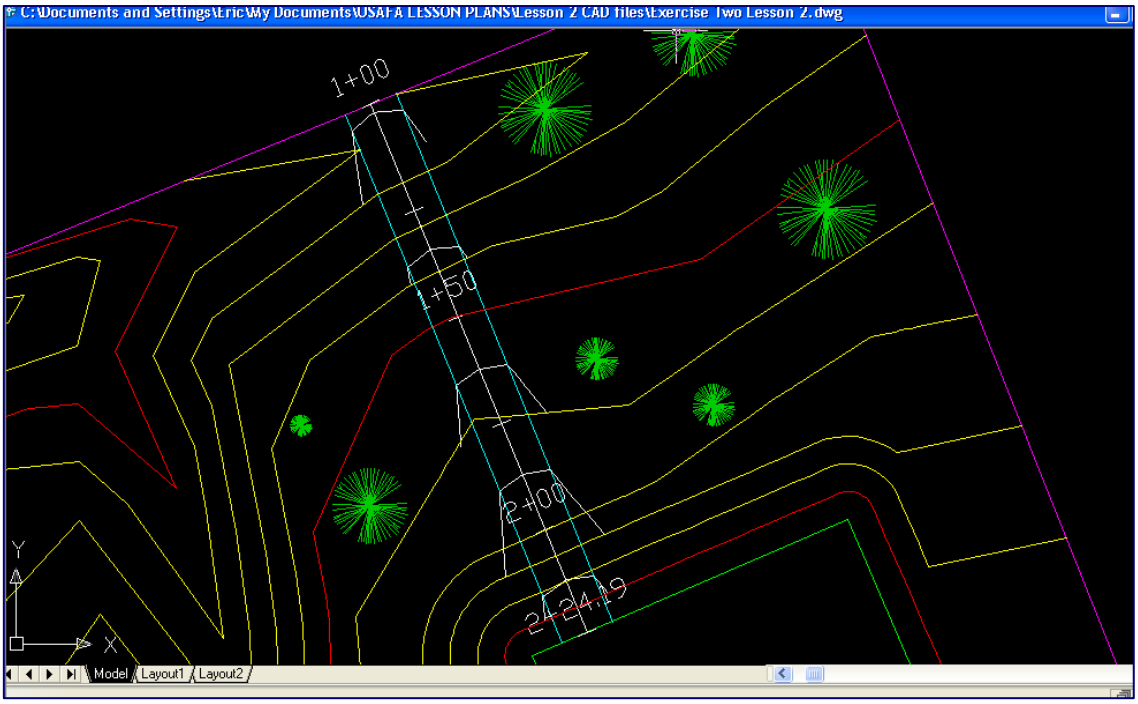
Hit enter to accept the default of <Yes> to **Erase old contours**.

AutoCAD will then draw in the new contours on the CONT-MNR and CONT-MJR layers. AutoCAD should display the following:



STEP TEN: CREATE THE DRIVEWAY EDGES

Create a new layer named EOA (Edge of Asphalt) and set current. Using the offset command, create both sides of the driveway at a 6' offset from the driveway alignment. AutoCAD should display the following:



At this point in the process, the contractor has all the information to create this driveway. Surveyors can use the drawing to set stakes and offsets for the driveway's alignment and grades. However, in reality, the engineer rarely ever gets the driveway correct on the first time. It is an iterate process. For instance, the profile was created to allow a drain pipe to be installed under the road at the ditch flowline. Performing a hydraulic analysis will determine the requirement for the pipe size. For this drawing, only a small pipe could be installed due to the minimal amount of cover. The engineer could decide to install a concrete pan in the flowline or regrade the ditch to allow for a larger amount of cover. AutoCAD makes this process easier by allowing the engineer to edit all of the variables.

Save the drawing as **Exercise 2 Lesson Two-Last Name.**

END OF EXCERCISE TWO

Return to Page 4

XCEL

Appendix A: Rational Method

JOB NAME: **Proposed Water Treatment Plant, Wolcott, CO**
CALCULATED BY: EWW — JOB NO. 1492
CHECKED BY: — DATE: 6/30/2006
SHEET NO. 1

RATIONAL METHOD CALCULATION SHEET

BASIN NAME: **BASIN A**

LAND USE: **UNDEVELOPED** — **DETAILS AND REFERENCE**

AREA: **72.00** Acres

HYDROLOGIC SOIL TYPE: **B** — See Appendix A, B, and C

TIME OF CONCENTRATION: Tc = **28.6** minutes — TC = ti + tt

	Length (f	slope (ft/ft)	vel.(ft/s)		
(Sheet Flow) ((0.395(1.1-C5)(L)^.5))/S^.33	500	0.150		16.5 t_i	See Appendix D for lengths
(Shallow Flow) V=CvSw^.5	725	0.010	1.0	12.1 t_t	See Appendix E for CV value

From Equations RO-3 and RO-4
Urban Storm Drainage Manual
Volume 1, June 2001

RAINFALL INTENSITY (I) — in./ hr.

From Town of Eagle IDF Curves (Table) — See Appendix F for Eagle County

I_2	
I_5	
I_{10}	1.4
I_{25}	1.9
I_{50}	
I_{100}	2.4

RUNOFF COEFFICIENT (C)

From Table RO-5
Urban Storm Drainage Manual
Volume 1, June 2001

C_2	0.04	
C_5	0.10	See Appendix G
C_{10}	0.19	
C_{25}	0.28	Estimated 5 Percent Imperviousness used due to small % of Asphalt Hwy
C_{50}	0.33	
C_{100}	0.38	

FLOW FROM RATIONAL METHOD (Q) — cfs

Q = (C*I*A)
From Equation RO-1
Urban Storm Drainage Manual
Volume 1, June 2001

Q_2	**0.00**
Q_5	**0.00**
Q_{10}	**19.43**
Q_{25}	**38.30**
Q_{50}	**0.00**
Q_{100}	**65.39**

0.157407407

JOB NAME: **Proposed Water Treatment Plant, Wolcott, CO**
CALCULATED BY: EWW JOB NO. 1492
CHECKED BY: DATE: 6/30/2006
SHEET NO. 1

RATIONAL METHOD CALCULATION SHEET

BASIN NAME: **BASIN B**

LAND USE: **UNDEVELOPED** **DETAILS AND REFERENCE**

AREA: **0.50** Acres

HYDROLOGIC SOIL TYPE: **B** See Appendix A, B, and C

TIME OF CONCENTRATION: Tc = **7.7** minutes TC = ti + tt

	Length (f	slope (ft/ft	vel.(ft/s)		
(Sheet Flow) ((0.395(1.1-C5)(L)^.5))/S^.33	108	0.150	7.7	t_i	See Appendix D for lengths
(Shallow Flow) V=CvSw^.5					See Appendix E for CV value

From Equations RO-3 and RO-4
Urban Storm Drainage Manual
Volume 1, June 2001

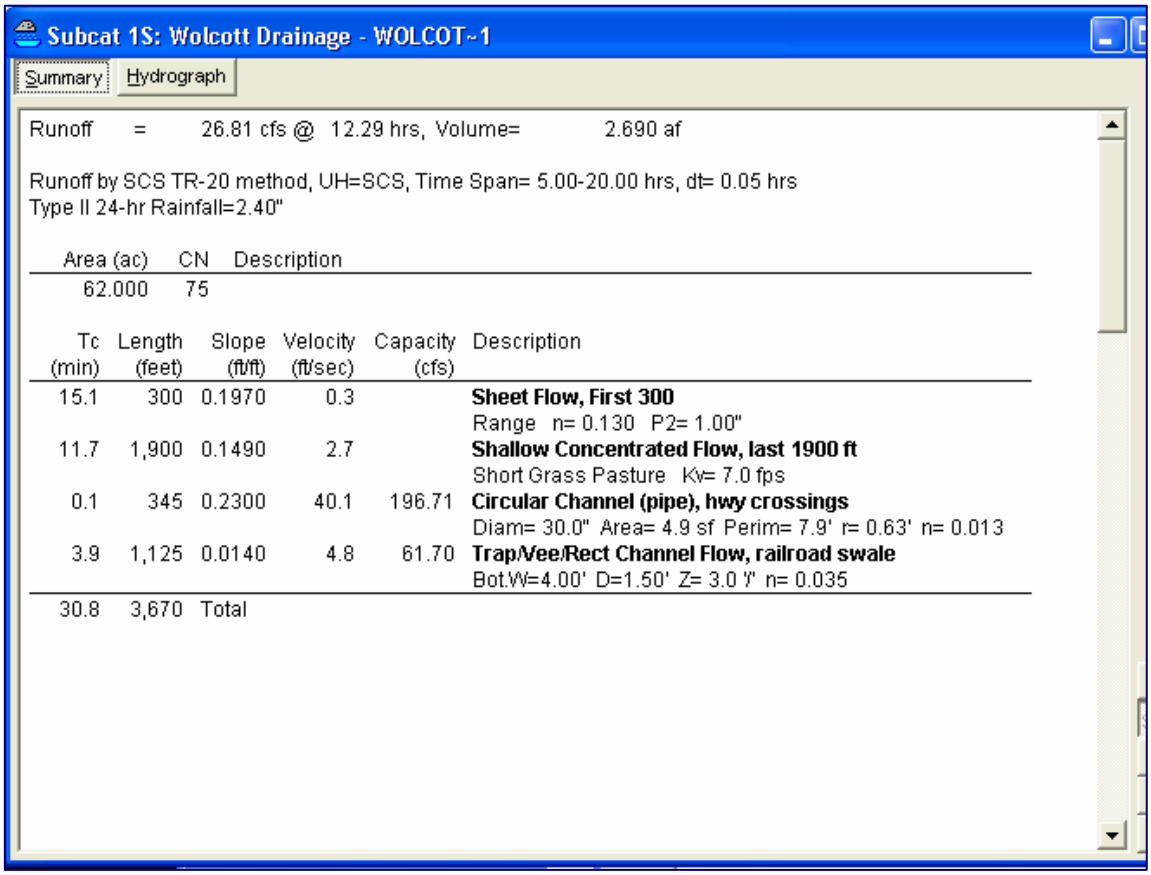
		in./ hr.	
RAINFALL INTENSITY (I)	I_2		
From Town of Eagle IDF Curves (Table)	I_5		See Appendix F for Eagle County
	I_{10}	1.4	
	I_{25}	1.9	
	I_{50}		
	I_{100}	2.4	

RUNOFF COEFFICIENT (C)	C_2	0.04	
From Table RO-5	C_5	0.10	See Appendix G
Urban Storm Drainage Manual	C_{10}	0.19	
Volume 1, June 2001	C_{25}	0.28	Estimated 5 Percent Imperviousness used due to small % of Asphalt Hwy
	C_{50}	0.33	
	C_{100}	0.38	

		cfs
FLOW FROM RATIONAL METHOD (Q)	**Q_2**	**0.00**
Q = (C*I*A)	**Q_5**	**0.00**
From Equation RO-1	**Q_{10}**	**0.13**
Urban Storm Drainage Manual	**Q_{25}**	**0.27**
Volume 1, June 2001	**Q_{50}**	**0.00**
	Q_{100}	**0.45**

CAD

Appendix B: HYDROCAD



Subcat 1S: Wolcott Drainage - WOLCOT~1

Summary | Hydrograph

Runoff = 26.81 cfs @ 12.29 hrs, Volume= 2.690 af

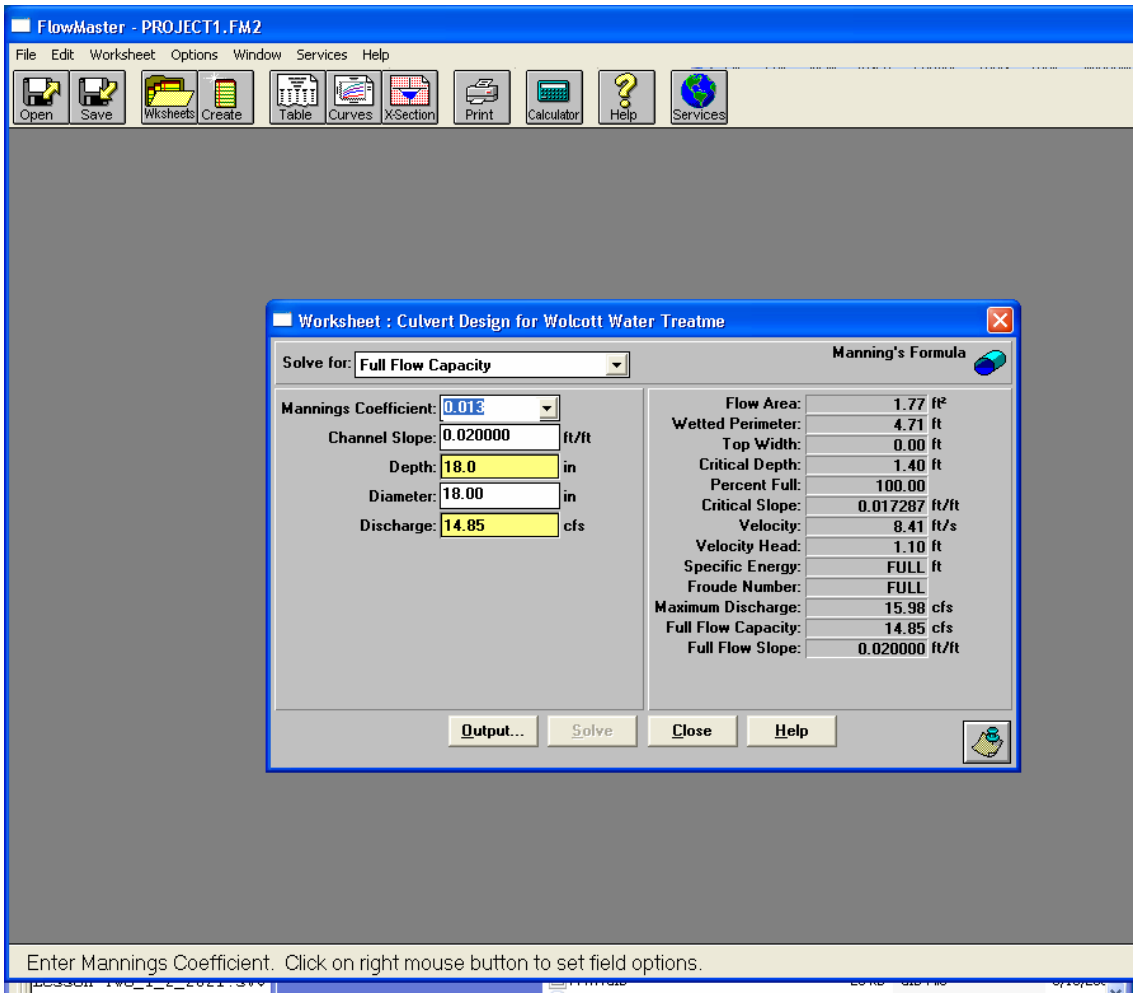
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=2.40"

Area (ac)	CN	Description
62.000	75	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	300	0.1970	0.3		**Sheet Flow, First 300** Range n= 0.130 P2= 1.00"
11.7	1,900	0.1490	2.7		**Shallow Concentrated Flow, last 1900 ft** Short Grass Pasture Kv= 7.0 fps
0.1	345	0.2300	40.1	196.71	**Circular Channel (pipe), hwy crossings** Diam= 30.0" Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
3.9	1,125	0.0140	4.8	61.70	**Trap/Vee/Rect Channel Flow, railroad swale** Bot.W=4.00' D=1.50' Z= 3.0 '/' n= 0.035
30.8	3,670	Total			

FM2

Appendix C: FlowMaster



APPENDIX E

PEAK LAND CONSULTANTS MANAGEMENT REVIEW

Peak Civil Engineering

Peak Land Surveying

PLC MANAGEMENT REVIEW

A COMPILATION OF OBSERVATIONS AND RECOMMENDATIONS OVER THE PERIOD FROM JUNE 2006 TO MAY 2007

BY

ERIC WATERS, P.E.

TEXAS A&M DE PROGRAM

8 May 2007

PLC PEAK LAND CONSULTANTS, INC.

ACKNOWLEDGEMENTS

First, I would like to thank Mark Luna and Brent Biggs for the opportunity to work at Peak Land Consultants over the past year. Without your support, I would not have been able to complete the requirements for the Doctorate of Engineering Degree from Texas A&M University.

I would also like to express my appreciation to the employees at PLC. I have learned a great deal from everyone.

Sincerely,

Eric Waters

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Outline of Review

- Management Topics
  - Company Goals
  - Time and Resource Utilization
  - Employee Interaction
  - Employee Evaluation
  - Communication
- Marketing
- Project Management
- Training and Professional Education
- Conclusions

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Company Goals: Background

- Unwritten Company Goal

  "Conduct business in a manner that allows employees the flexibility to work and play in a mountain community"
  - ✓ Basis of the high morale at PLC
  - ✓ Key to future success
- Formal Company Goals
  - No formal goals established
  - Potential source for concerns
    - What will the happen to PLC when Brent retires?
    - Is the company planning to expand?

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Company Goals: Recommendations

- Brent and Mark discuss a 1, 5, and 10 year plan
  - Serve as basis for developing company goals
- Formalize company goals to address key concerns
  - Will the company expand?
  - Will PLC continue to rely on referral business?
  - What will happen to company when Brent retires?
- Present goals to company at informal event
- Discuss and update goals on an annual basis
- Use goals during employee evaluations

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Time & Resource Utilization: Background

- Unique construction period leads to distinct busy and slow periods
  - Company takes advantage of slow periods for employee leave, etc.
  - Difficult to anticipate how much new work is coming
  - Difficult to plan for new capital improvement items
- Mark's position is used as a safety valve during busy times
  - Great for solo work on smaller projects and/or help with specific items on other engineer's projects
  - Source of concern when number and type of projects start to interfere with responsibilities as Senior Project Manager
- Engineers are becoming too specialized
  - Source of concern if one or more engineers leave during same period

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Time & Resource Utilization: Recommendations

- Use company goals to determine optimum level of business
- Hire an entry level civil engineer (E.I.T) on yearly contract
  - Allows company to evaluate situation without long term commitment
  - Alleviates pressure on Mark allowing for more focus on PM duties
- Take steps necessary to equalize engineering expertise in office
  - Have other engineers more involved in Eagle River Water & Sewer projects
  - Focus new training in areas where engineers are weaker
  - Allow engineers to sit-in on other engineer's reviews with clients

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Employee Interaction: Background

- Keeping things on a professional level is difficult w/ small companies
  - There is a good balance at PLC between professional and social interaction
  - Knowing a person's particular personality and mood is key
  - Always have to be aware of time spent in discussing non-work related topics
- Office conflict
  - Majority of conflict is based around professional disagreements
  - Conflicts are not always resolved immediately
  - Lost productivity means lost profit

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Employee Interaction: Recommendations

- Keep up the balance between professional and social interactions
- Ensure an outside social event occurs every couple of months
  - Keeps you up to date with major changes in employees personal life
  - Effective gauge on the moral of the office
  - Continue the organized sporting events (softball, golf, etc.)
- Resolve any conflicts as quickly as possible
  - Discourage the office gossip mill
  - Prevents loss in productivity

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Employee Evaluation: Background

- No formal policy on employee evaluations
- Everyone handled on case by case basis
  - Employees left to decide when to approach management for raises, etc.
  - Provides no incentive for increasing productivity or job knowledge

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Employee Evaluation: Recommendations

- Establish time table for employee evaluations
- Set performance goals for each employee
  - Tie goals to increases in pay, benefits, etc.
  - Goals can be as simple as “Keeping up the high quality work!”
  - Goals could include bringing in new business for the company
- Provide regular feedback
  - Praise employees for “job well done”

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Communication: Background

- Occasional breakdowns occur in office
  - Professional disagreements on best solutions
  - Lost time due to breakdown between PCE and PLS such as the use of wrong file or multiple surfaces for add-ons to existing projects
- Communication between engineers
  - Employees not shy about asking for help
  - Person who has the best answer is not always in the office
- External communication
  - Breakdowns often occur when construction starts
  - Interruptions in day to resolve out of scope issues such as utility conflicts
  - Close relationship with many clients is a key factor in securing repeat business

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Communication: Recommendations

- Communication in the office
  - Recognize when discussions become counter-productive
  - Use conflict management techniques to resolve the issues
  - Attend training seminar on communication skills
  - Invite John to at least one staff meeting a month to discuss issues
- Communication between engineers
  - Establish a “command of the day” repository
  - Discuss new techniques in staff meetings
- External communication
  - Ensure a clear chain of command is established for the contractor
  - Emphasize situational awareness when prospective clients are present

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Marketing: Background

- Current strategy is based on reputation and repeat business
  - Works well with PLC’s strong reputation for excellent work and immediate response to any problems or unexpected needs
  - Allows substantial savings in marketing costs
- Marketing needs in conjunction with construction seasons
  - Marketing not a large concern during peak periods
  - Emphases in “drumming up” new business only discussed towards the end of peak periods

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Marketing: Recommendations

- Encourage more outside employee interaction with community
  - Time paid for attending town council meetings, charity events, etc.
  - Small bonuses for bringing in new business
  - More interaction through activities, golfing, major sporting events, etc.
- Build and maintain PLC website
  - Showcase talents to prospective clients
  - Provide real time updates to ongoing projects
- Limiting marketing campaign one month prior to start of busy seasons
  - Advertise in local papers
  - Publish info on recent projects completed on website

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Project Management: Background

- PLC does not have any full time project managers
  - Project management functions dictated by type of project and contract
  - PLC clients typically perform project manager duties
- PLC does not use any project management software
  - Project data base includes input from everyone in office
  - Updates on project schedules handles during staff meetings or as needed

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Project Management: Recommendations

- PLC purchase at a minimum Microsoft Project Management
  - Track major milestones in projects
  - Allows decisions to be made on when and if new projects can begin
  - Allows employees to plan out vacation time
  - Good tool for organizing staff meetings
- Integrate software into entire business
  - Links through website can provide clients with schedule updates
  - Avoids conflicts in scheduling of redesigns by clients
  - Investigate hybrid programs that combine data management functions

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Training & Prof. Education: Background

- PLC does not have a formal training process or training budget
- PLC does encourage training for all its employees
  - Training usually occurs during off-peak periods
  - PLC planning training for AutoCAD Civil 3D
- PLC supports professional education
  - Mark provided encourage and advice for Nina's P.E. exam
  - No requirement to date from Colorado to renew P.E. license

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Training & Prof. Education: Recommendations

- PLC should set up a formal training budget
  - Encourages everyone to find a useful course at least once a year
  - Can be tied to company goals
  - Allows flexibility to take short notices classes
  - Leads to increase in productivity or capabilities

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Conclusions

- PLC is a successful and well respected company
- Management Review focused on several areas
  - Company Goals
  - Time and Resource Utilization
  - Employee Interaction
  - Employee Evaluation
  - Communication
  - Marketing
  - Project Management
  - Training and Professional Education
- Management review success based on quality of discussion initiated

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